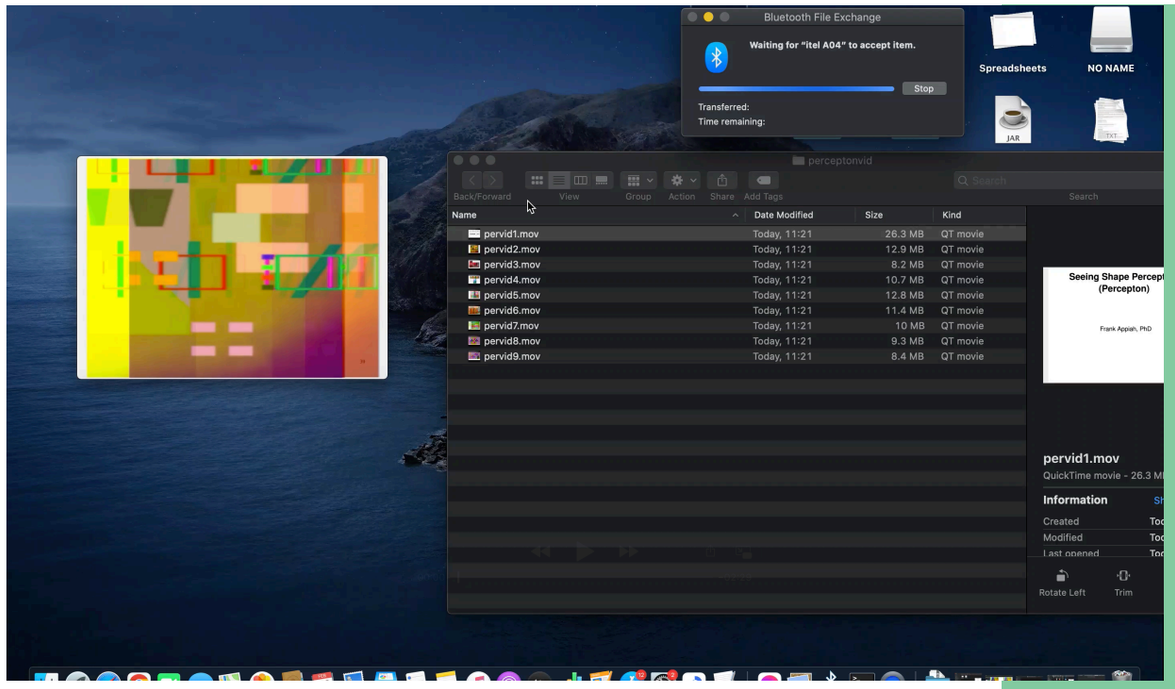


Bluetooth File Exchange

MIT Media Laboratory

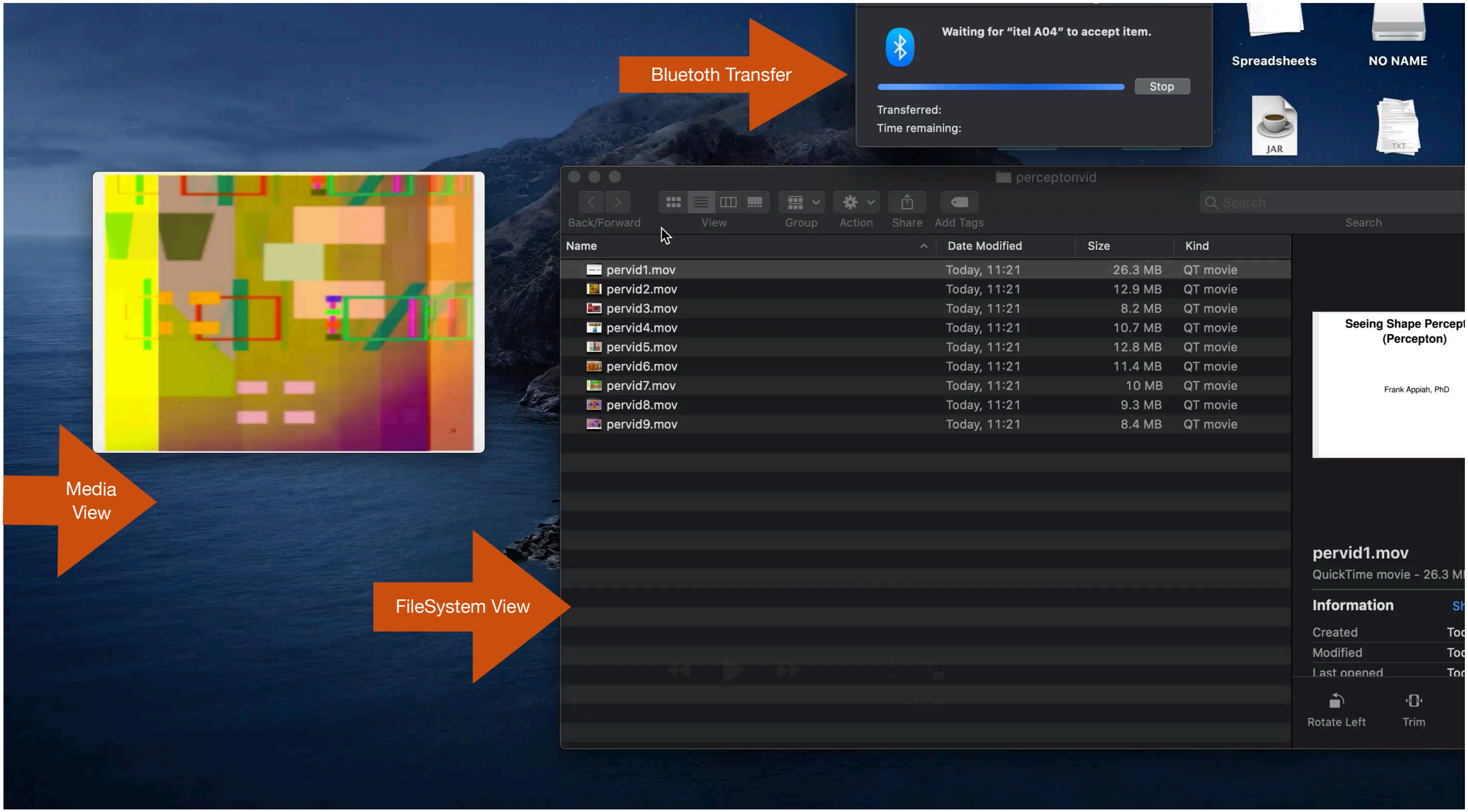
Massachusetts.

(2025)

Dr Frank Appiah

Media-Time Analysis on Bluetooth File Transfer Profile Model Usage.

(Personal Area Network)



Bluetooth File Exchange

What is Bluetooth?

Bluetooth is a short range wireless technology standard(10 metres) medium for exchanging files like image, video, sound and others between two communication devices like mobile-to-mobile or mobile-to-computer or device-to-machine. It is used in building personal area network.

In most widely use case, it needs about 2.5.milliwatts of transmission power to deliver a very short range up to 10 metres (33 ft). It employs UHF radio waves in the ISM bands from 2.402GHz to 2.48 GHz. ISM stands for industrial, scientific and medical purposes reserved portion of radio spectrum

Bluetooth Symbol.

UHF is Ultra. High Frequency that designates ITU radio frequencies in range between 300 MHz and 3GHz. It is also known as decimetre band as the wavelength range from one meter to one-tenth of a metre.

The file transfer protocol defines applications that require bluetooth devices necessary for the support of the File Transfer usage model. The requirements are expressed in terms of end-user devices and by defining the features and procedures that are required for interoperability between Bluetooth devices in the File Transfer usage model.

The scenario covered is the transfer objects (copying) between two bluetooth devices thus from a mobile enabled Bluetooth device and a Laptop/PC initiated bluetooth device.

What to look at for?

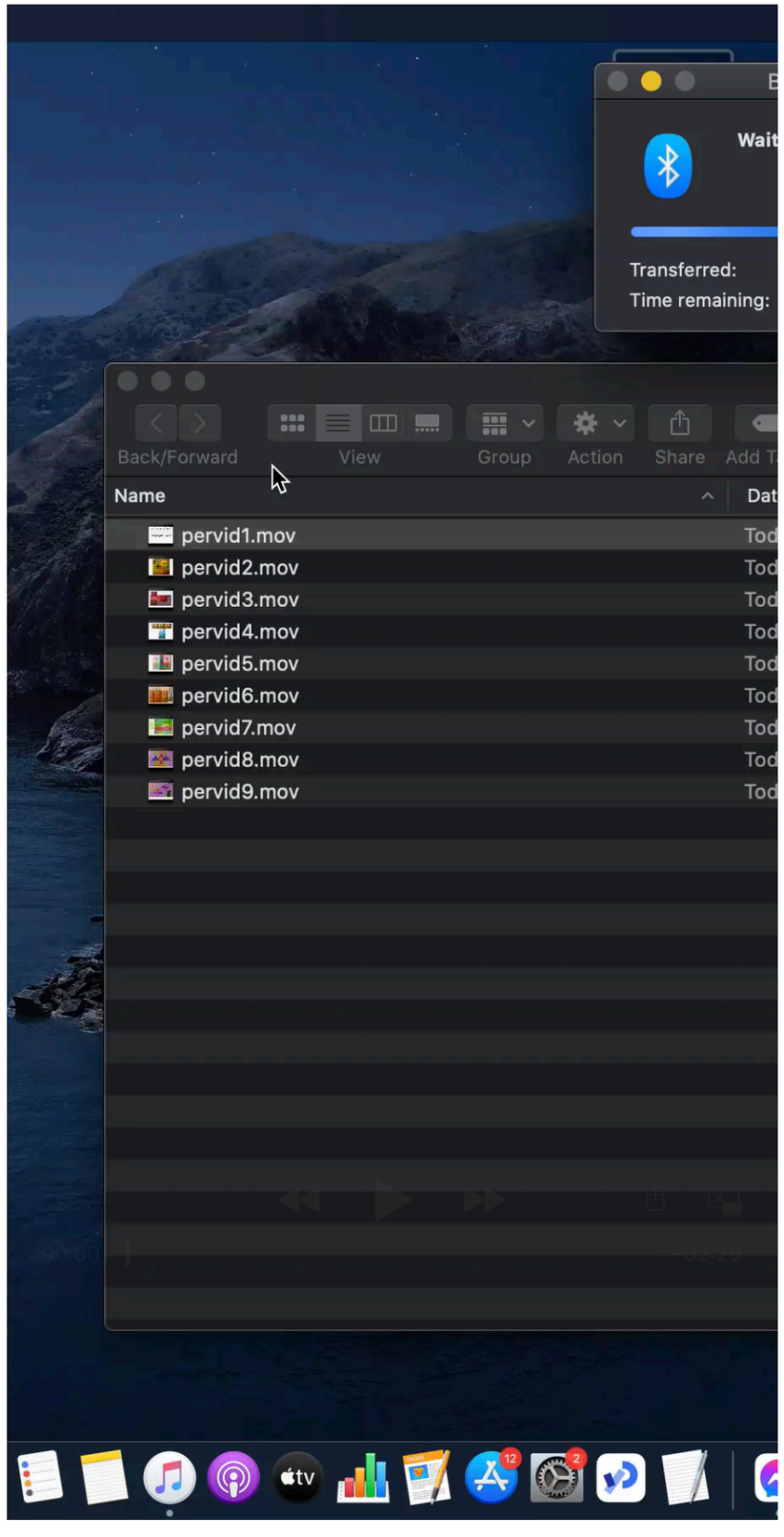
Contents

1. Introduction to File System View

2. Media Content View

3. Bluetooth Exchange View

4. Media-Time Analysis



Bluetooth File Exchange

This introduction will discuss the several videos that are used as media format for Bluetooth communication between a mobile device with Android operating system and a computer with Mac operating system. Each device is enabled with bluetooth media support builtin.

The system identification for a successful media communication are:

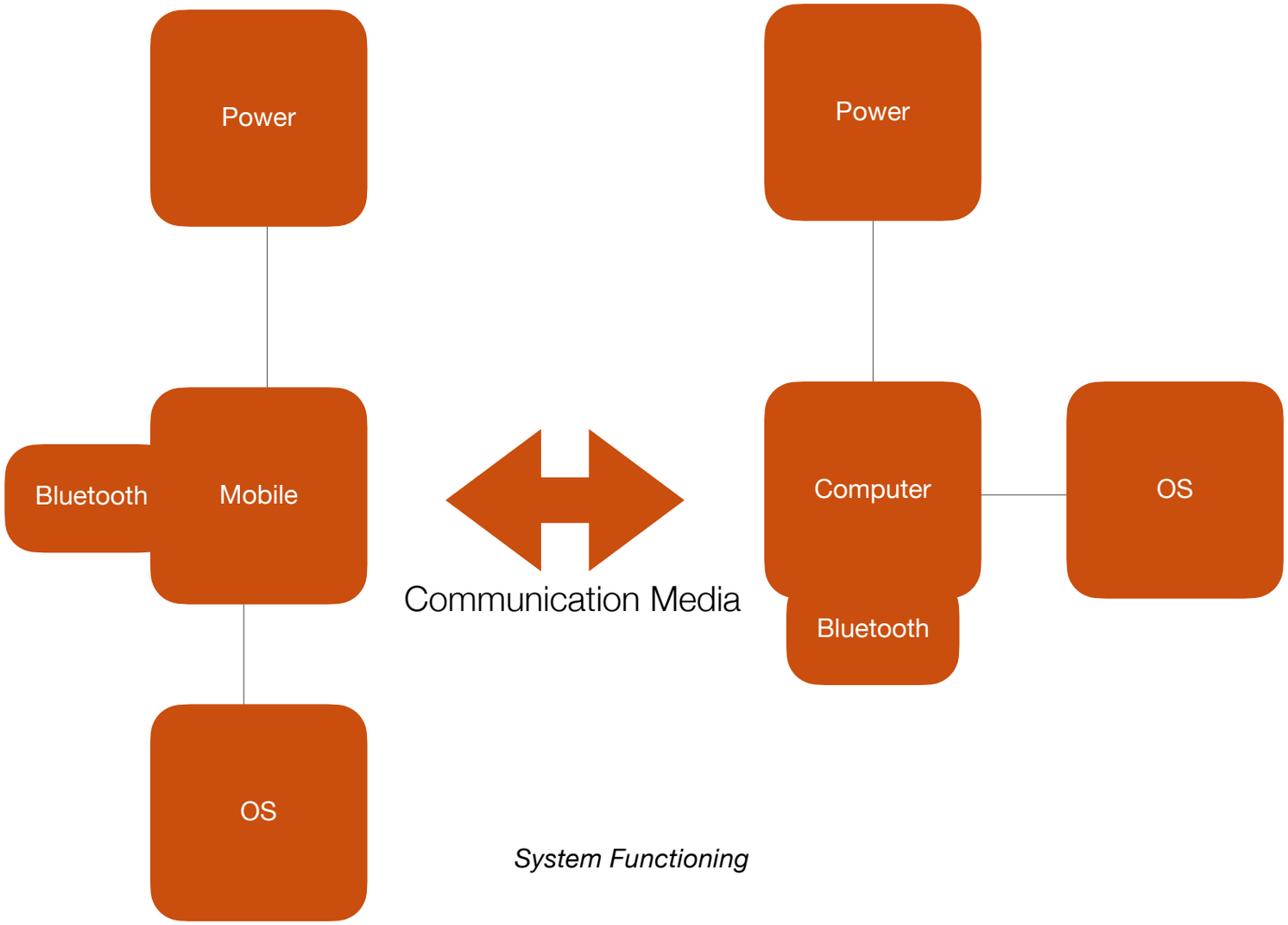
1. Bluetooth Media System

2. Power System

3. Communication System and

4. Operating System.

Please note some compatibility issues can arise in pairing unsupported bluetooth device with any bluetooth device. MacBook Pro supports one direction only bluetooth communication with my Android Device. A bidirectional or two-way communication can supported on other devices.



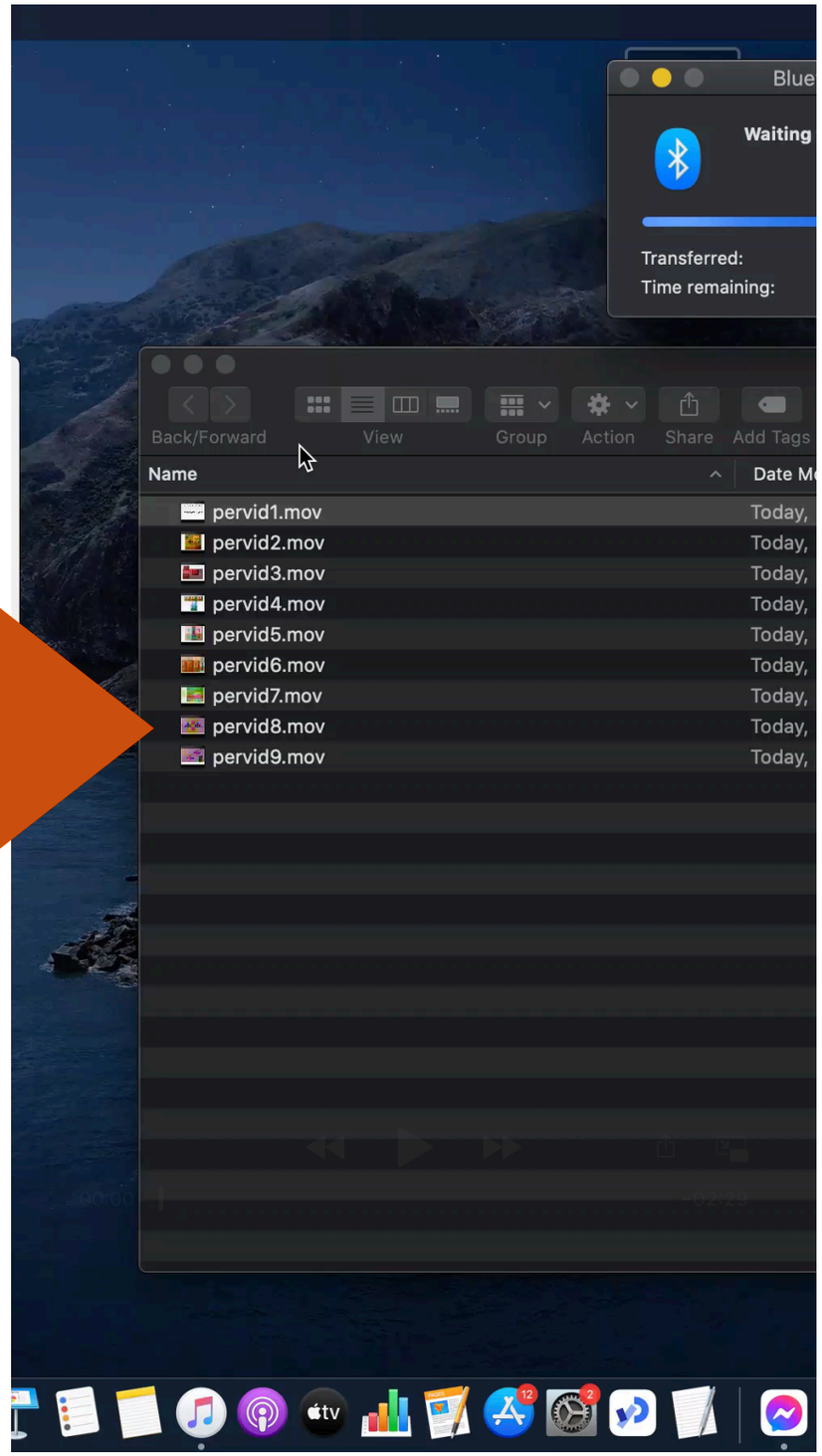
System Functioning

1. File System View

The pictorial view of the Mac machine is shown on the right side. In there are 9 movie files that are being prepared to be sent to a mobile device with an Internet support to publish the videos to Youtube.

There are 9 file names with each having pervid# where # is 1 to 9.

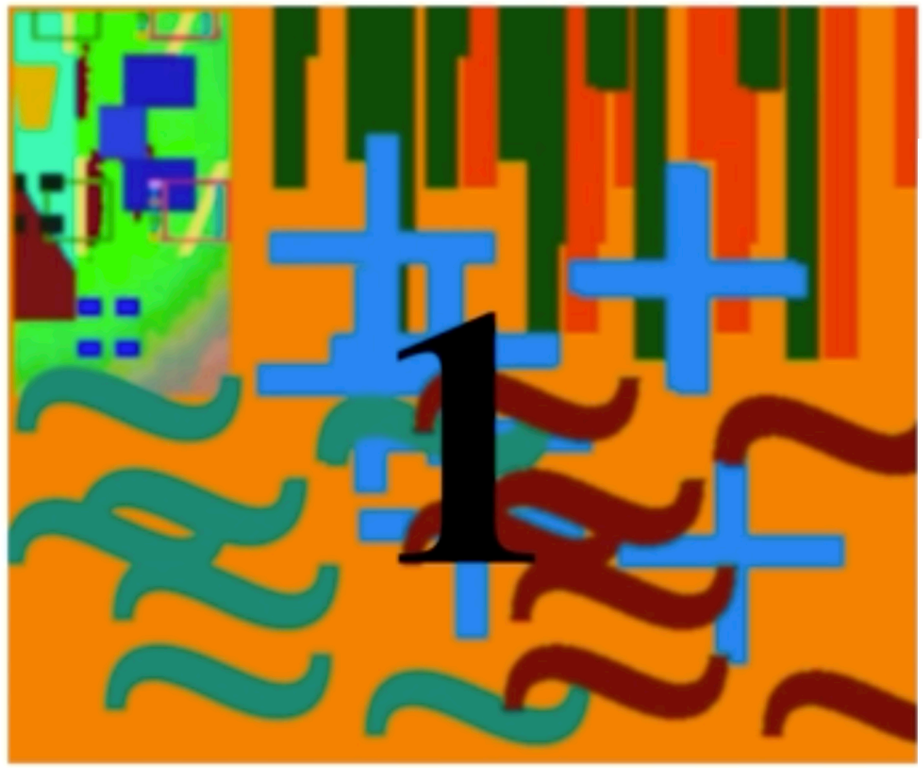
Nine Pervid Videos

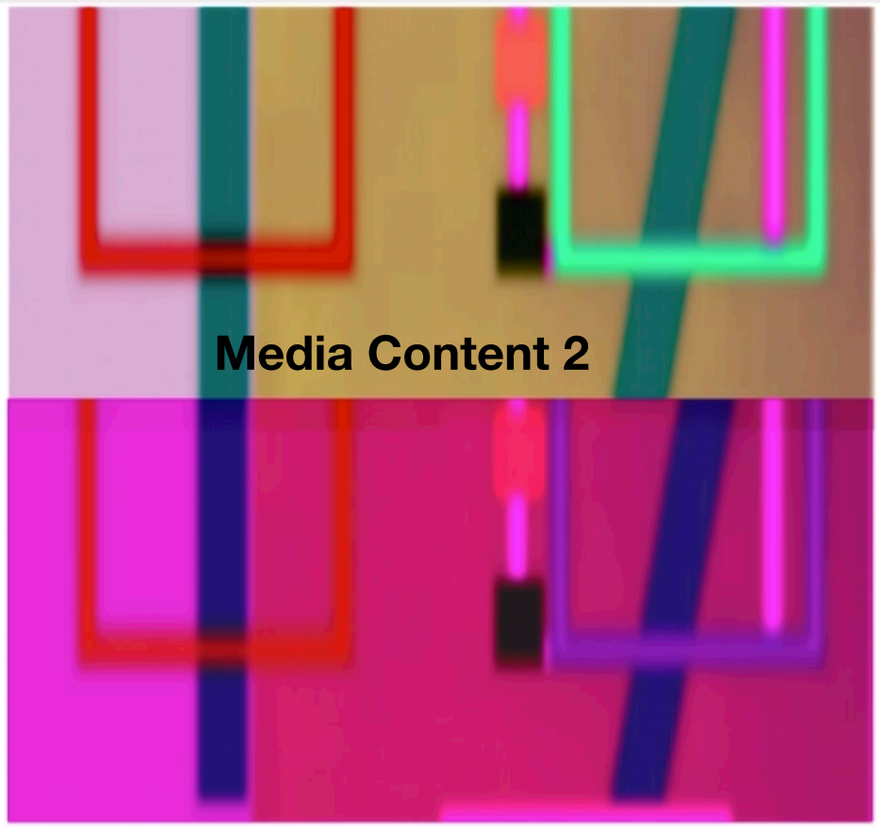


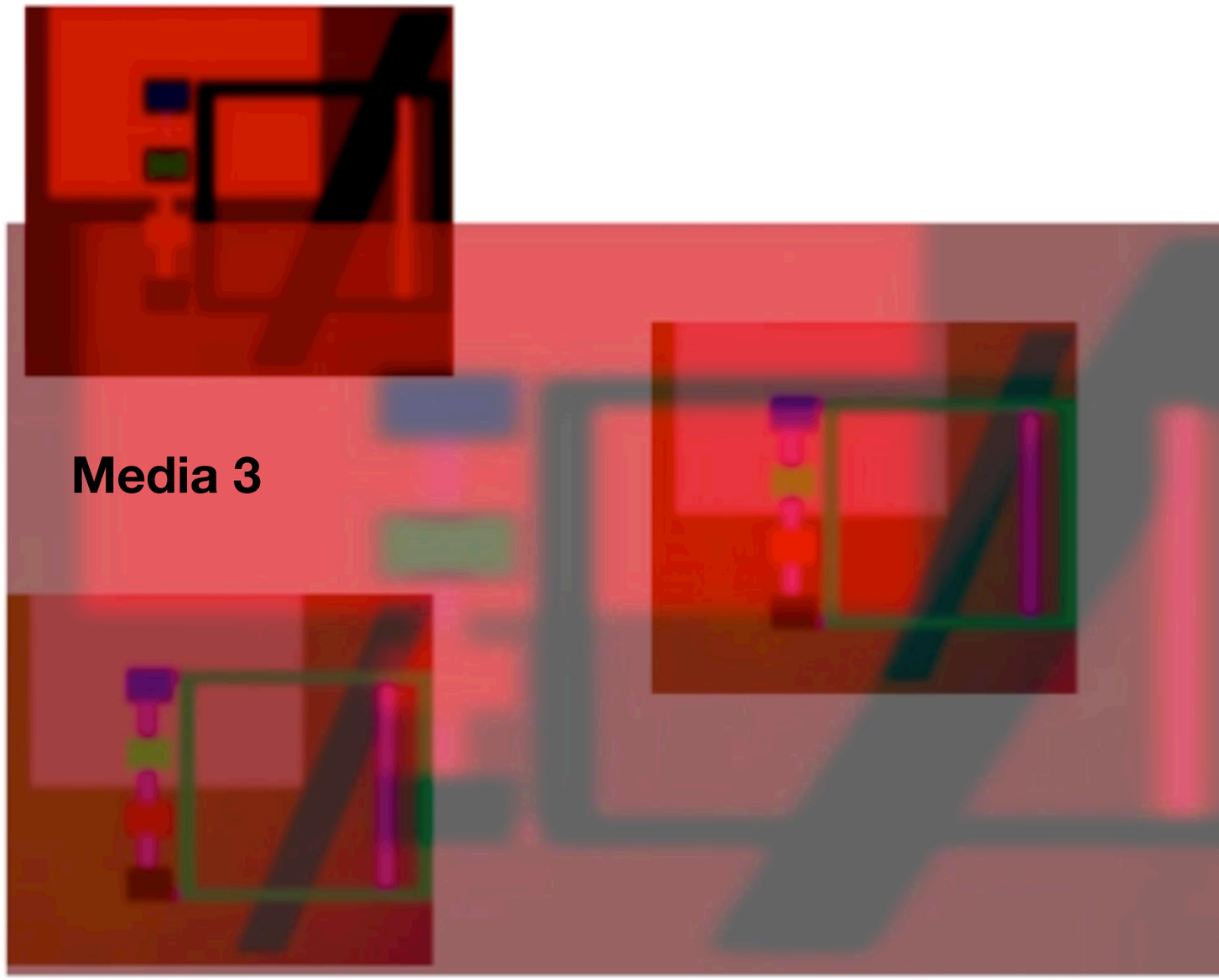
Computer - File System View

2. Media Content View.

Percept

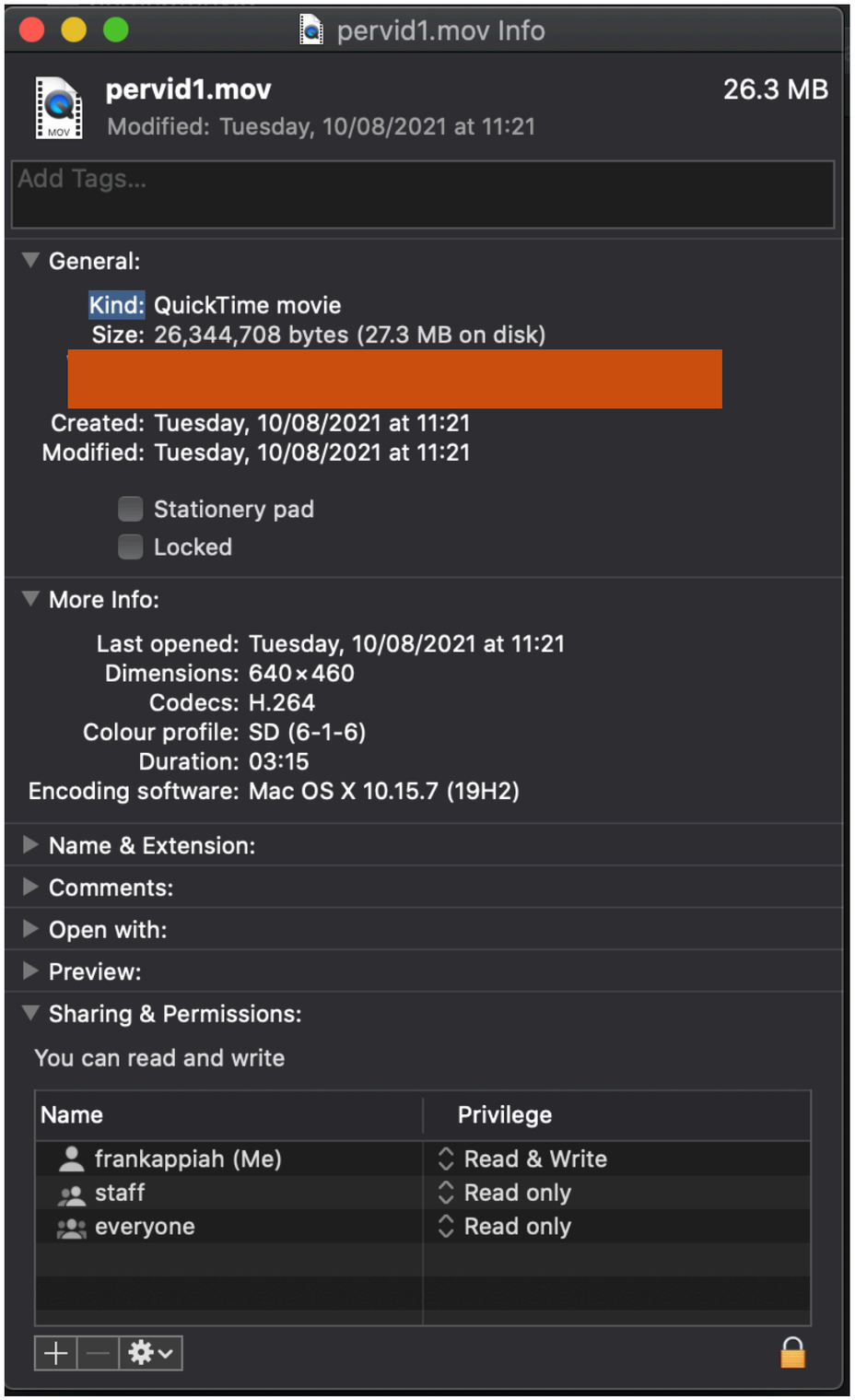


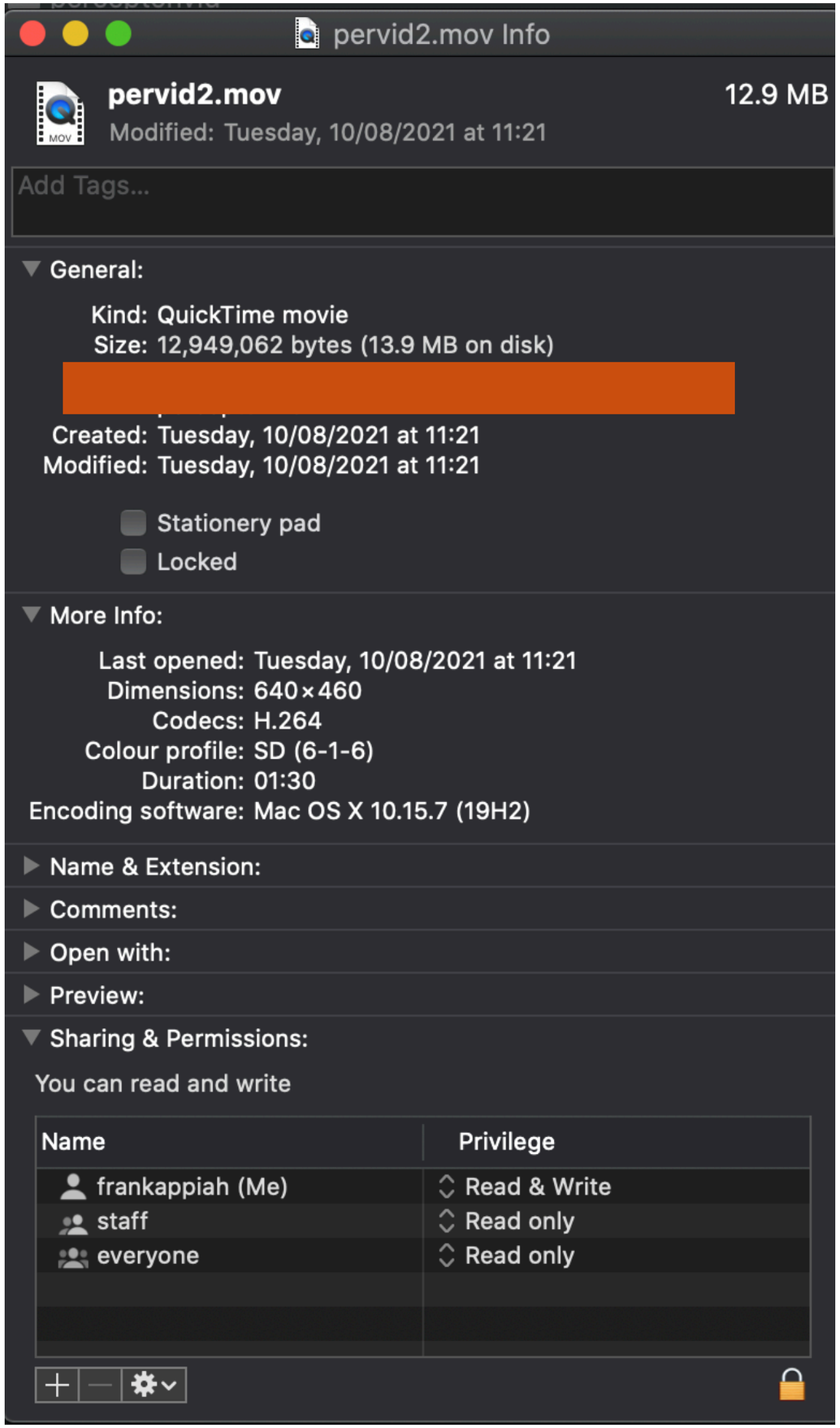




Media Information on Content 1.

1. Look at the kind of file.
2. Look at the size of file.
3. Look at the creation date of file.
4. Look at the modification date of file.
5. Look at the dimensions of file.
6. Look at the codec of file.
7. Look at the colour profile of file.
8. Look at the media duration of file.
9. Look at the encoding software of file.
10. Look at the sharing and permissions of file.





Media Information on Content 2.

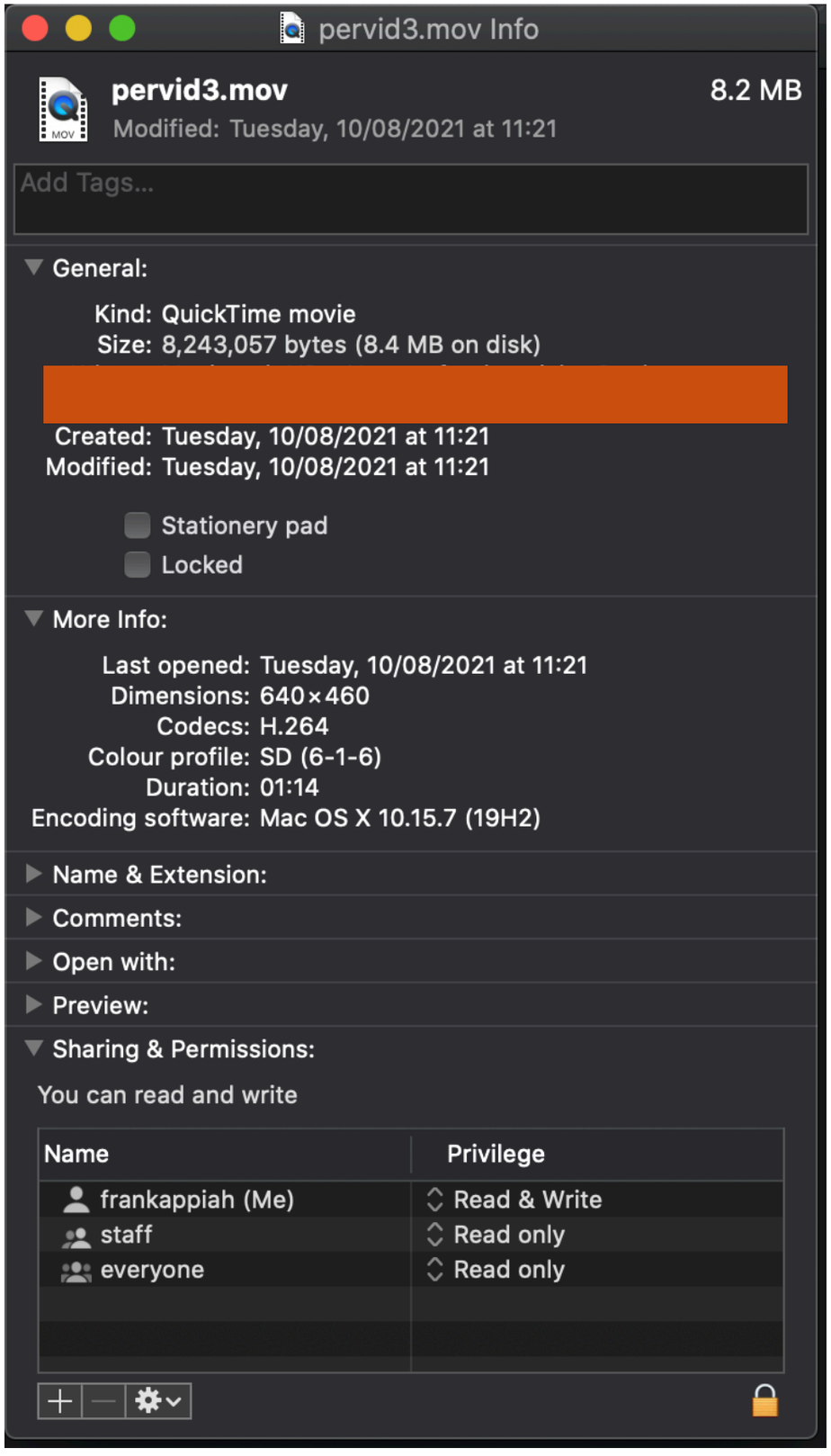
Media 1 > Media 2

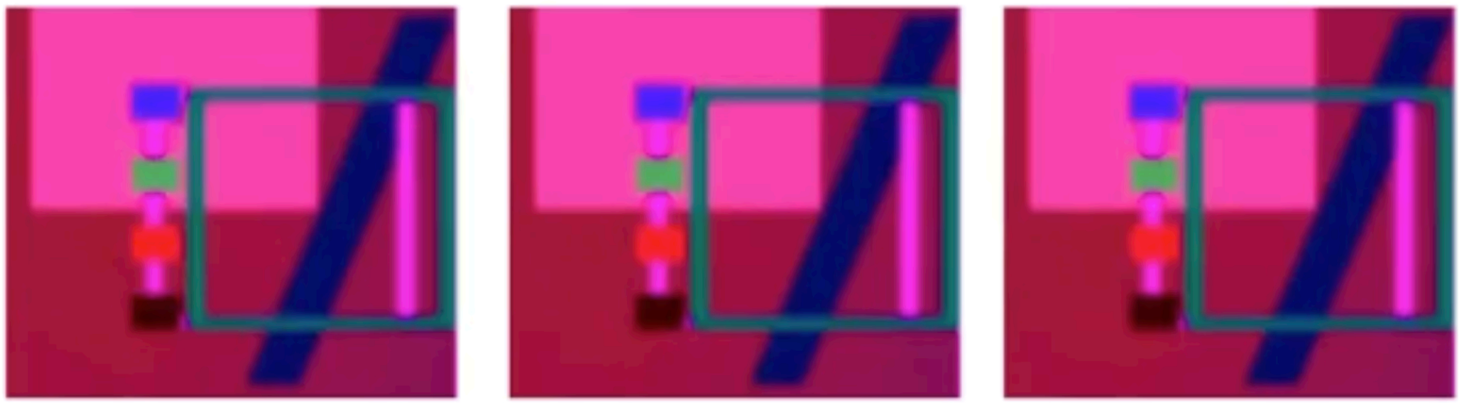
26.3MB > 12.9MB.

Media Information on Content 3.

Media 2 > Media 3

12.9MB > 8.2MB





Media 4

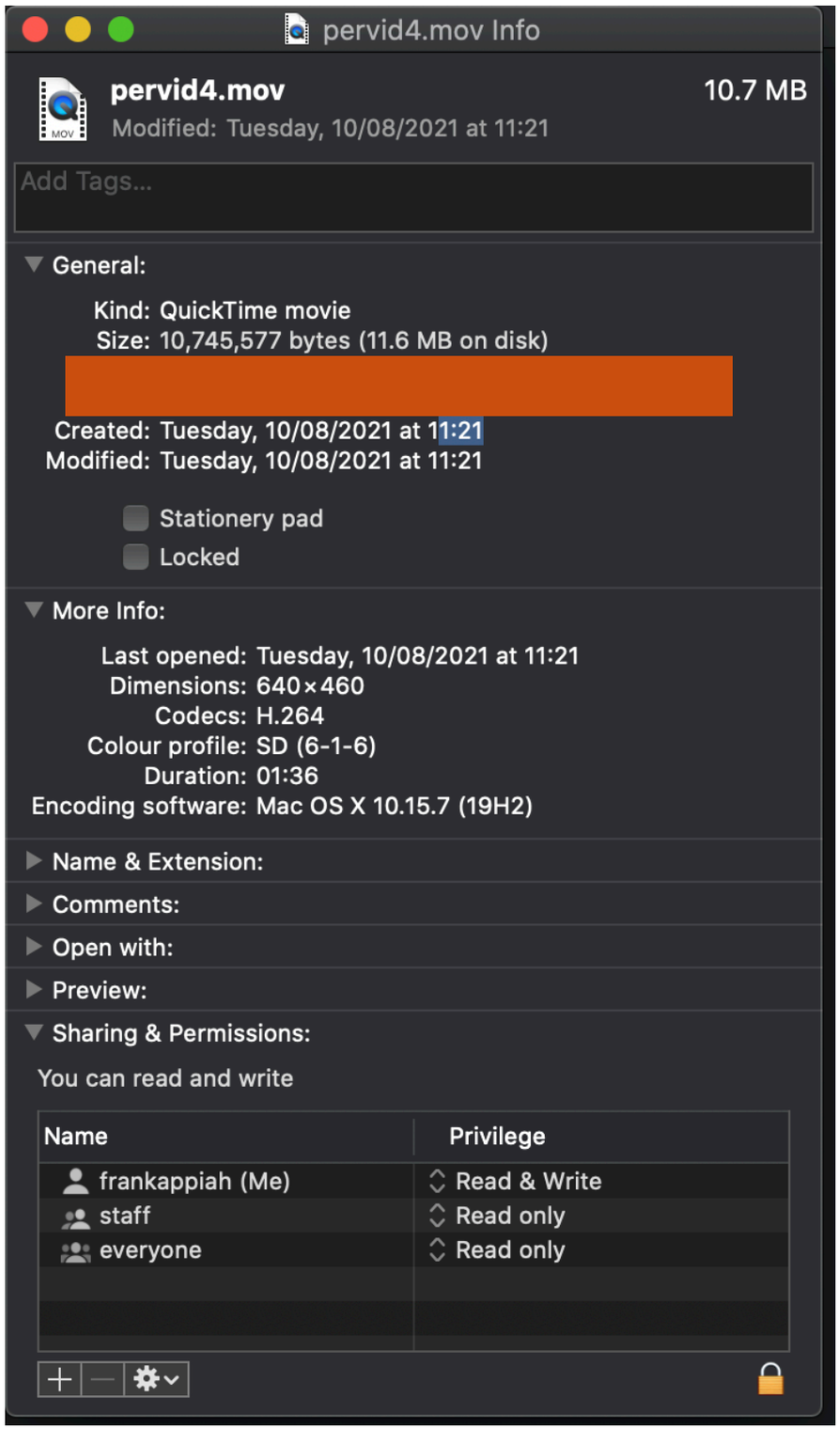
71

1- 10 Look Threads

Media information 4.

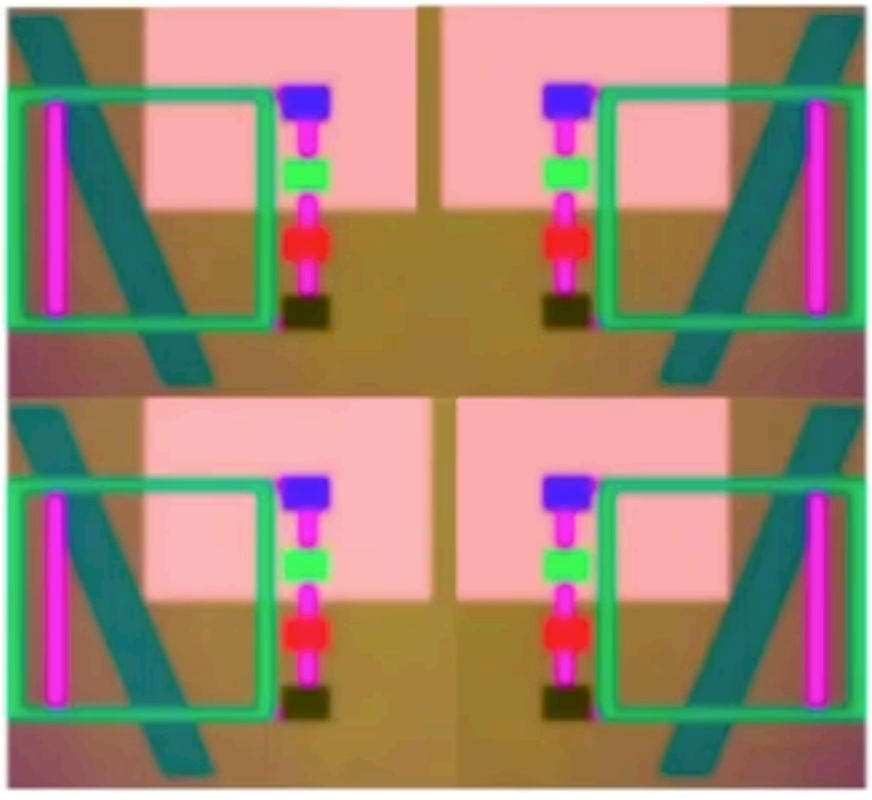
Media 3 < Media 4

8.2MB < 10.7MB



Gamma=1.0

Media 5



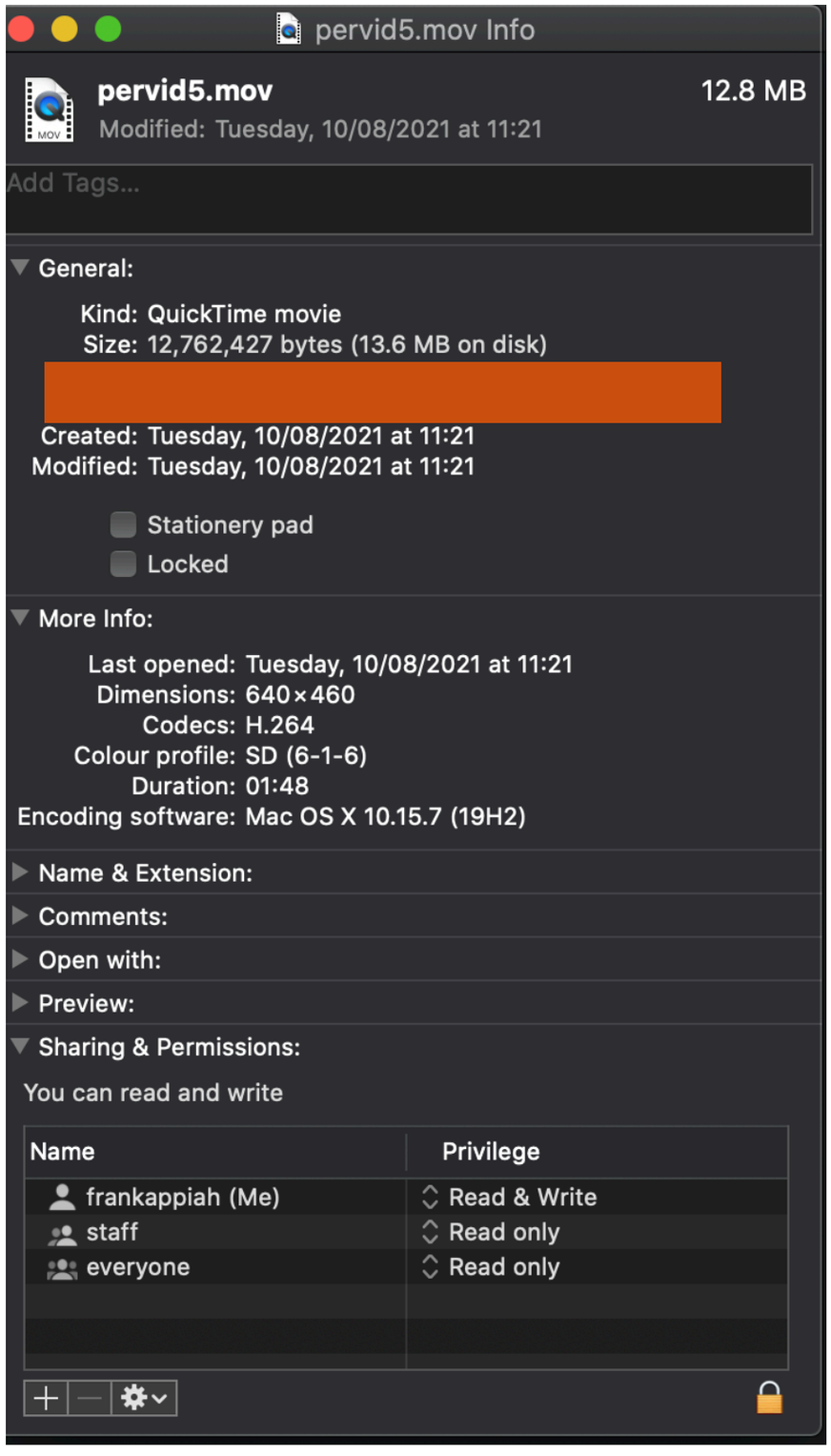
84

1- 10 Look Threads

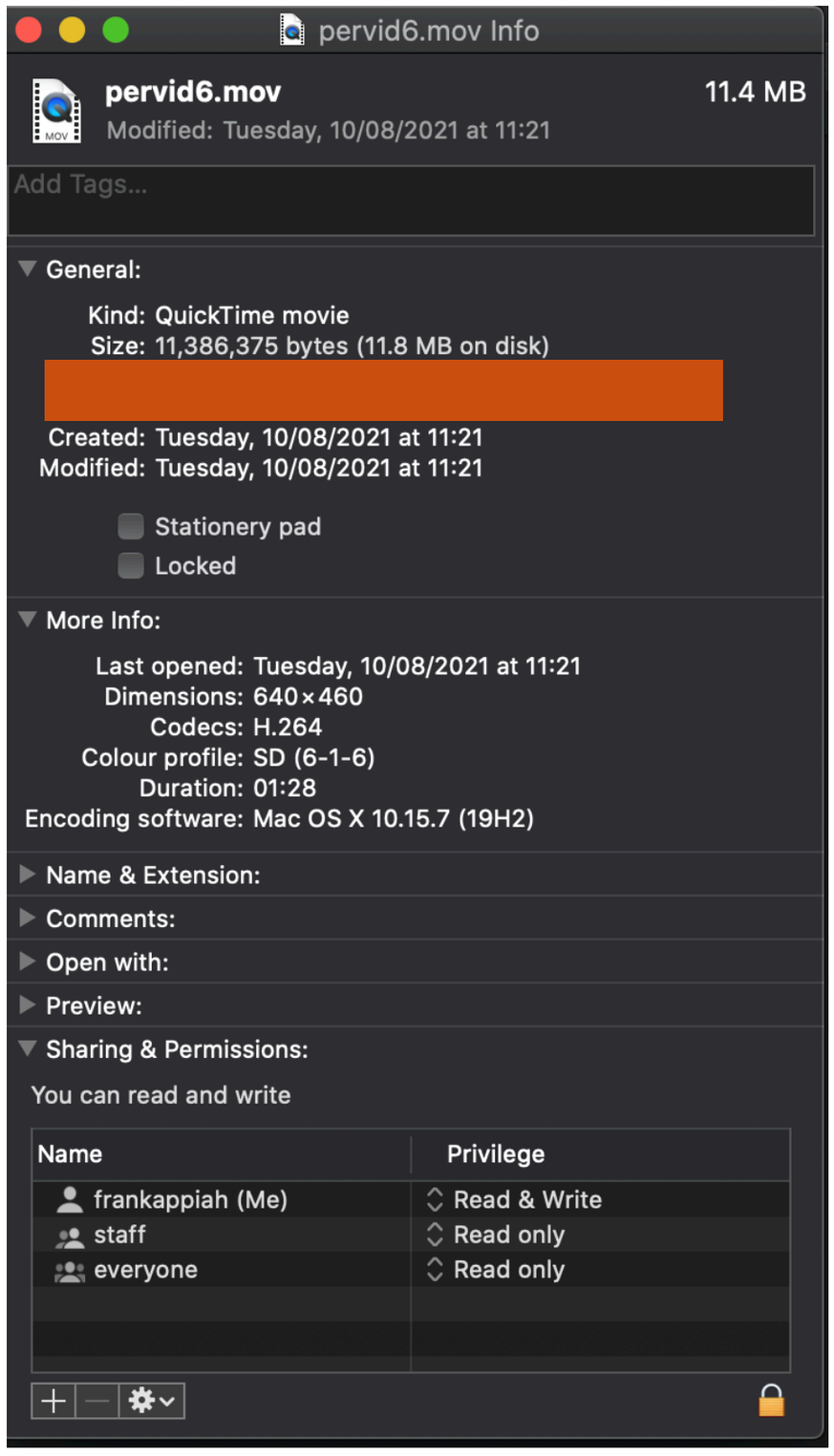
Media information 5.

Media 4 < Media 5

10.7MB < 12.8MB



Media 6



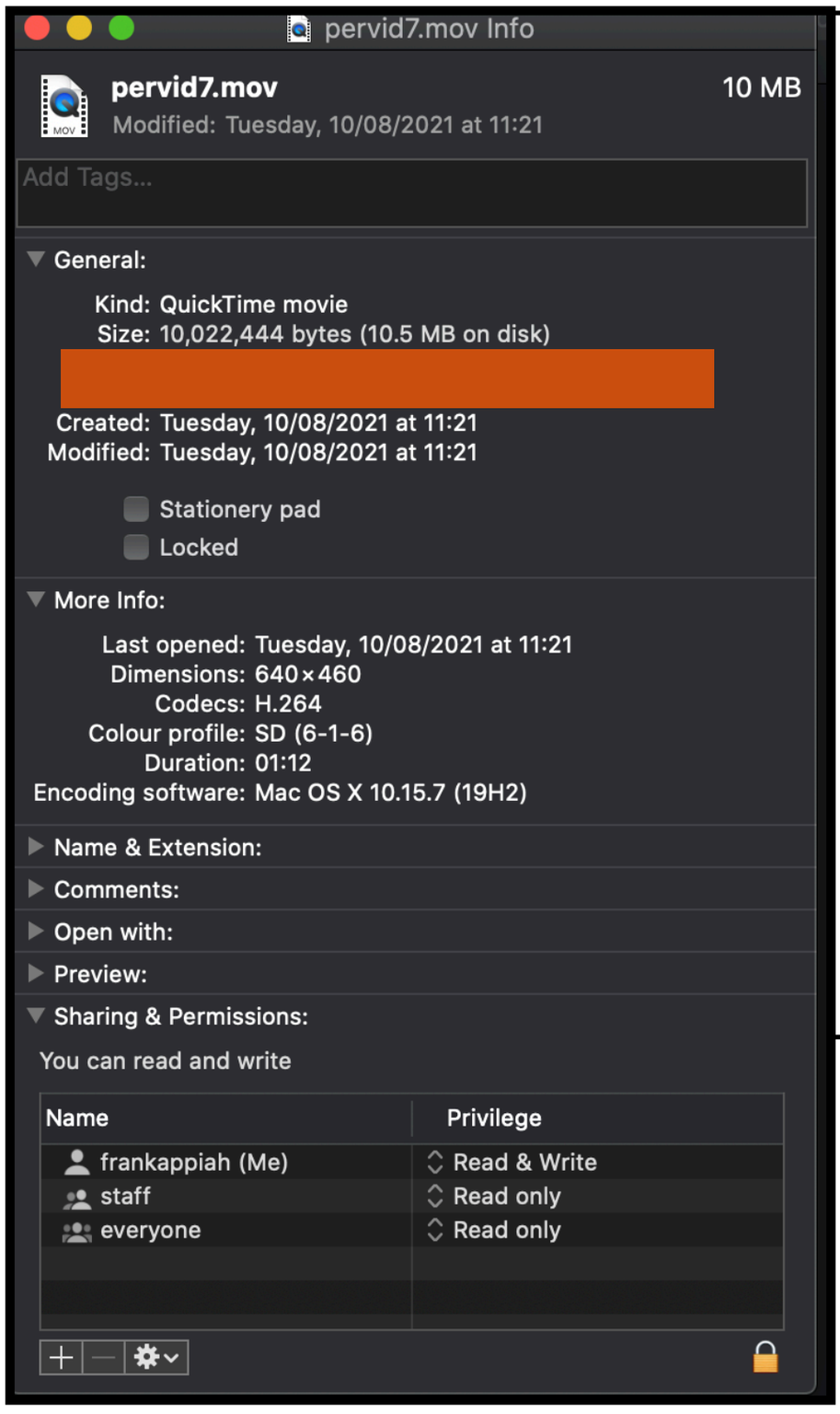
1- 10 Look Threads

Media Information 6.

Media 5 > Media 6

12.8MB > 11.4MB.

Media 7

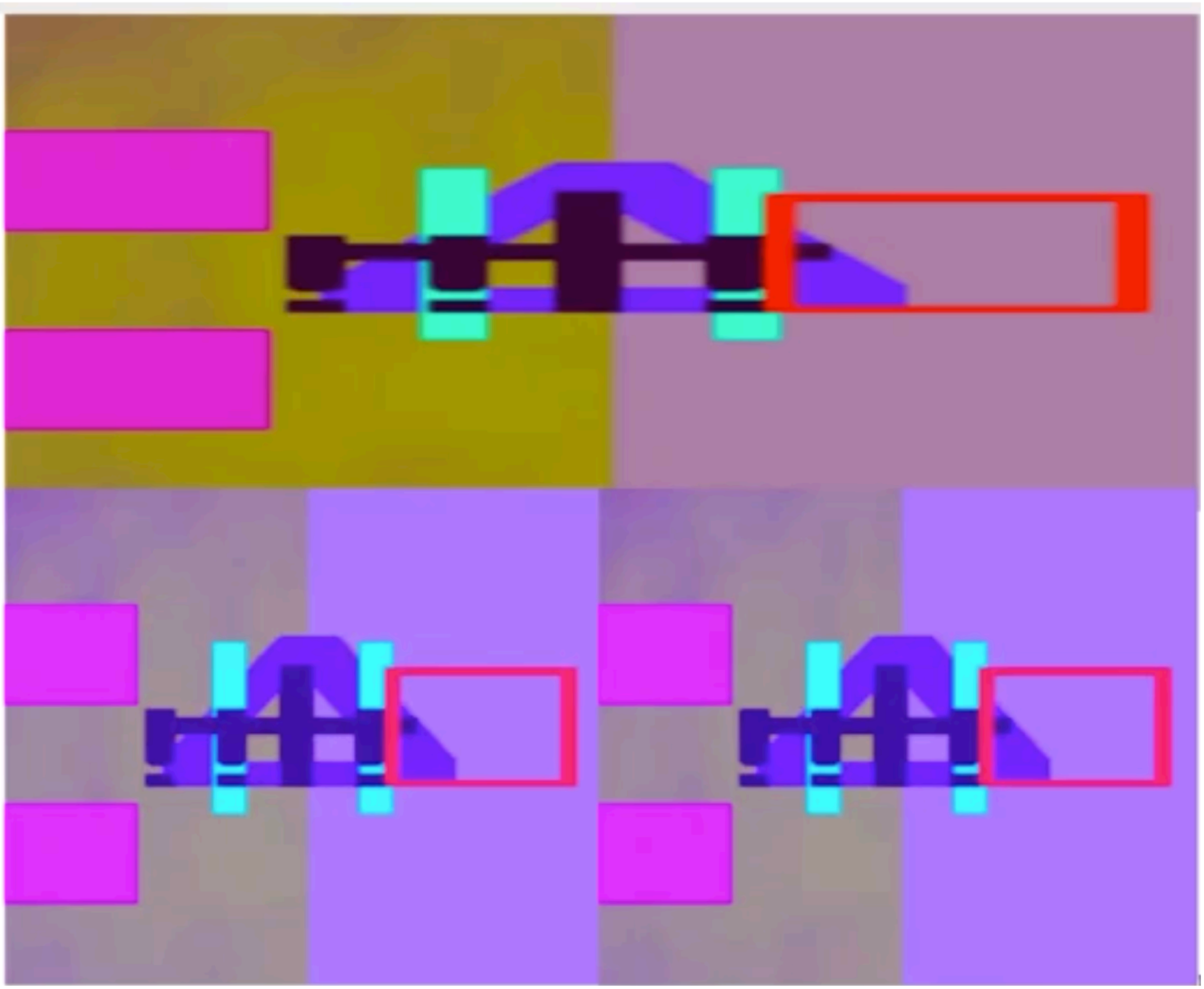


1- 10 Look Threads

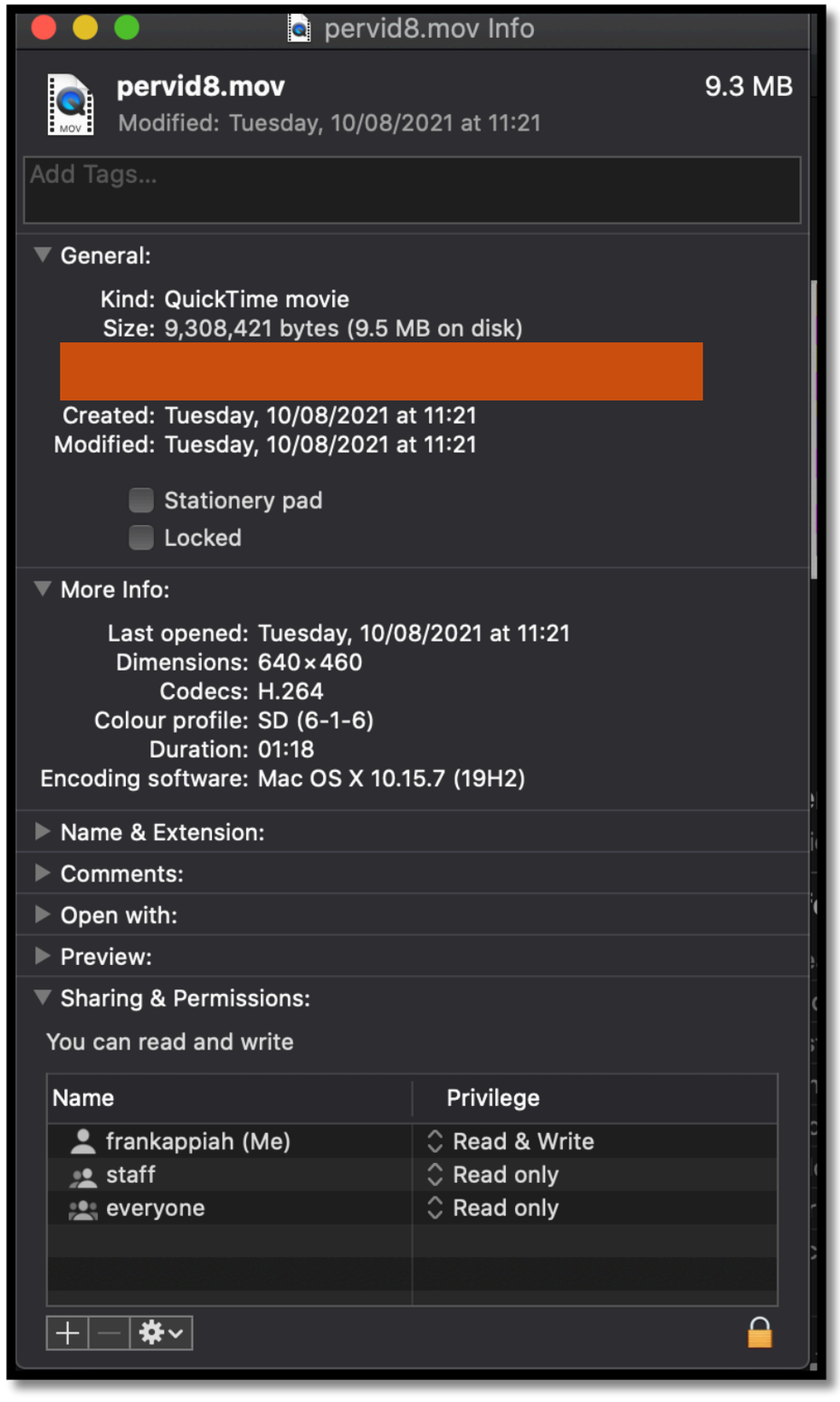
Media Information 7.

Media 6 > Media 7

11.4MB > 10MB.



Media 8

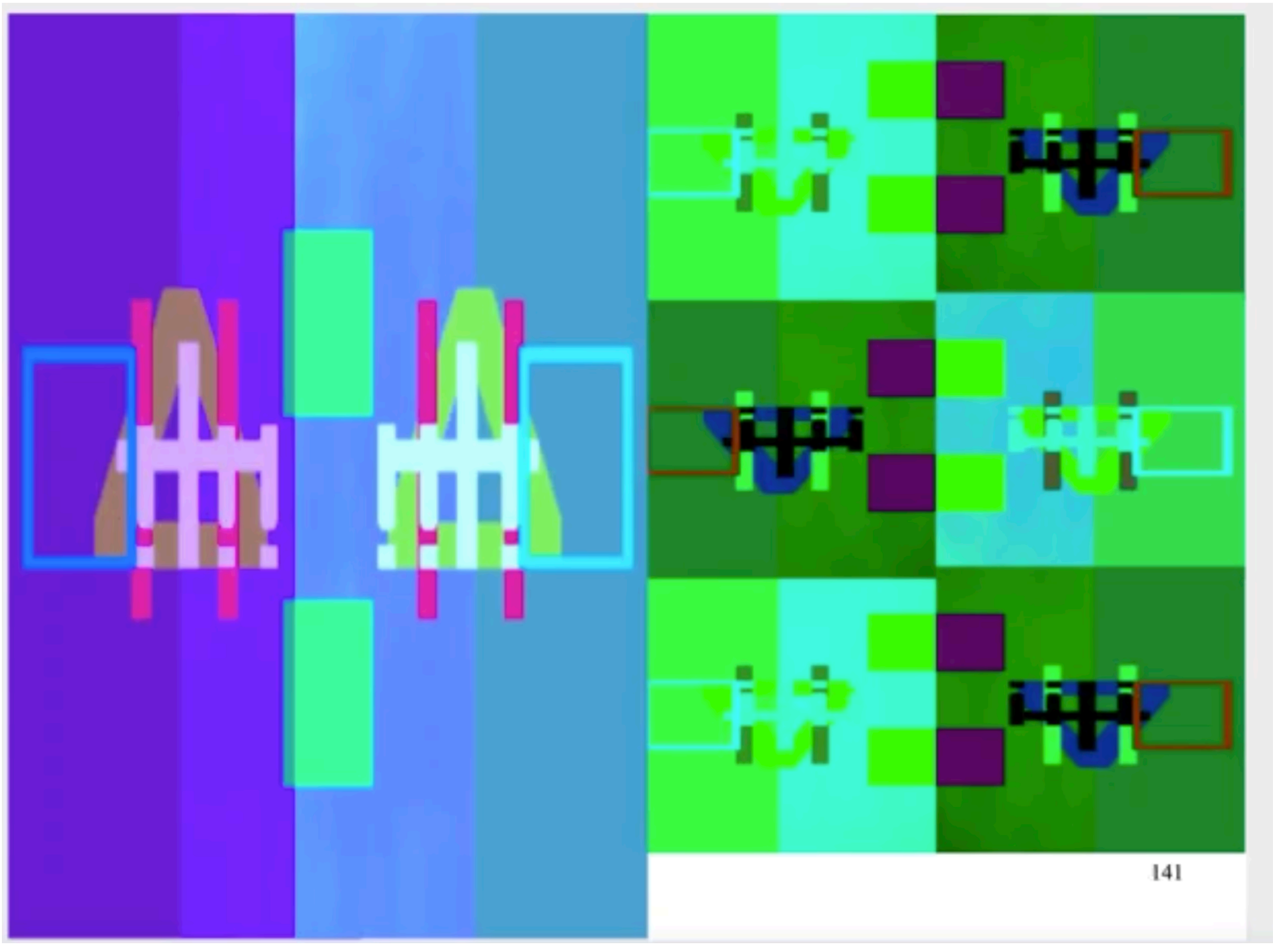


1- 10 Look Threads

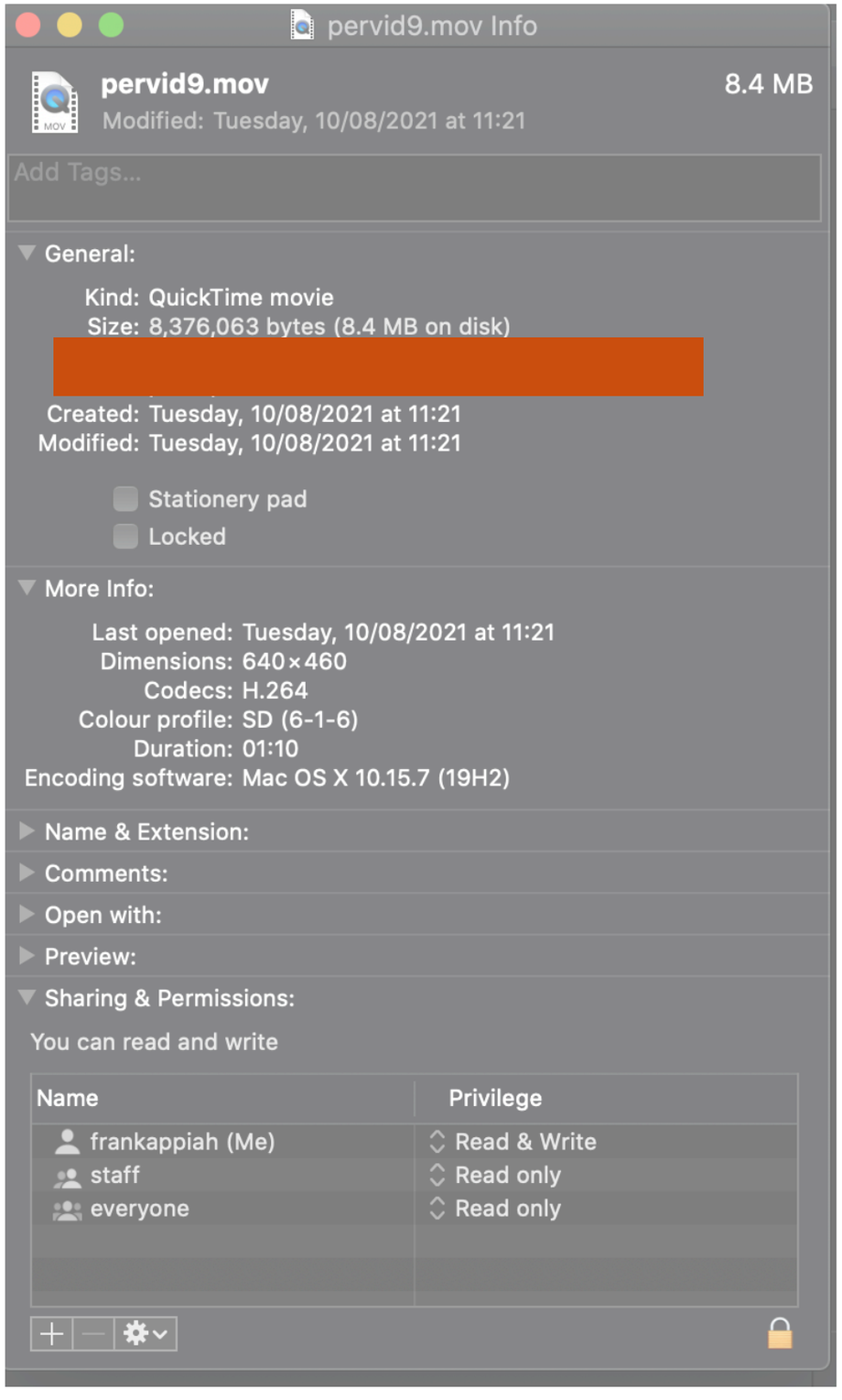
Media Information 8.

Media 7 > Media 8

10MB > 9.3MB.



MEDIA 9



1- 10 Look Threads

Media Information 9.

1- 10 Look Threads

Metadata Information 9.

Media 8 > Media 9

10MB > 8.4MB.

These images captured from the video media were made from Perceptor Graphics Tool that I developed for a visual graphics perception. Perception made from large shapes of comma, dot, exclamation sign and more.

1. Content 1 have shapes comprising of plus, tilde, line, dot, trapezoid and more.

2. Content 2 have shapes comprising of hollow square, (slanted) line and filled squares.

3. Content 3 have shapes comprising of filled rectangle arranged vertically, hollow square, slanted lines and a background image.

4. Content 4 is perceived cuts into some of the media content. For this example perceived image is content 3.

5. Content 5 is made from arrangement in 2x2 form of content 4.

6. Content 6 is made from a replica of content 5 in addition to the previous content.

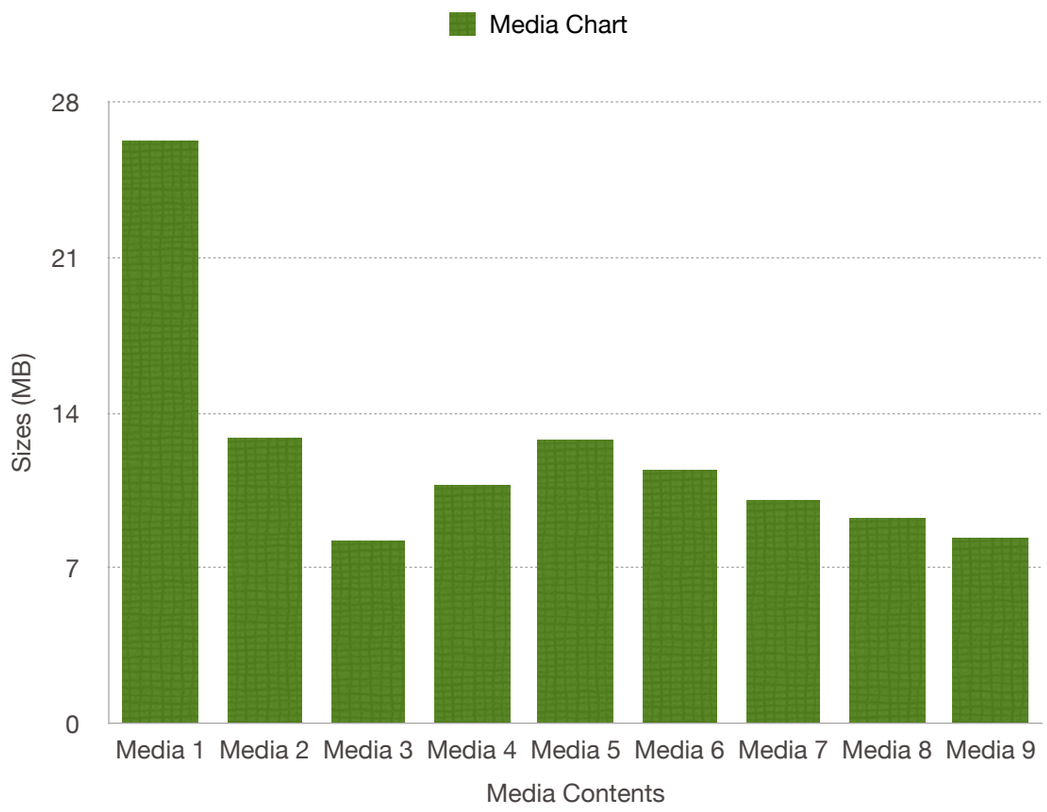
7. Content 7 is made from overlaid of three rectangle shapes, trapezoids, hollow rectangle with missing breath, etc.

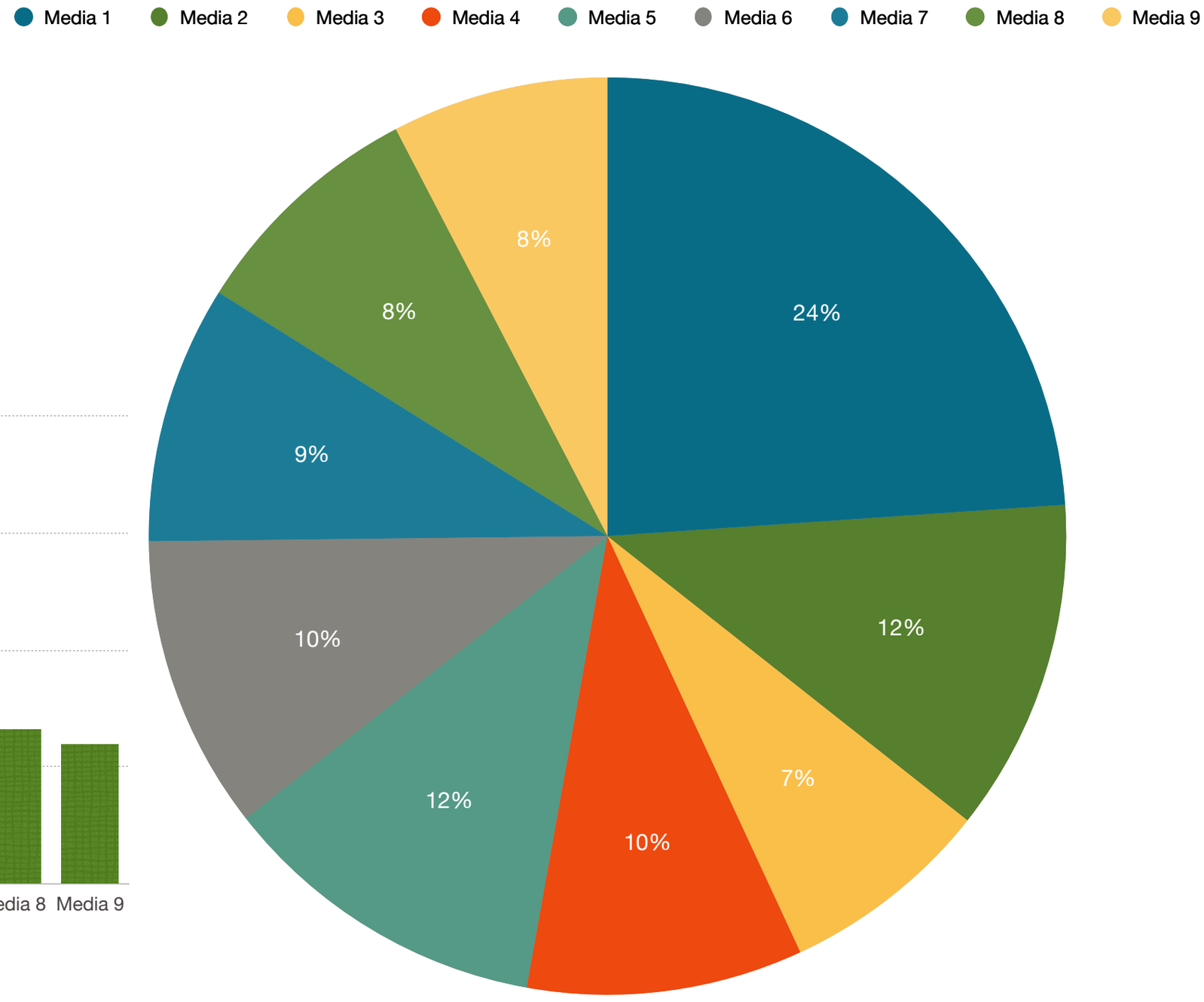
8. Content 8 is made from a top view cut from a perceived content and placed a a two smaller joined content.

9. Content 9 is made from a left cut perceived image placed into three top layer arrangement.

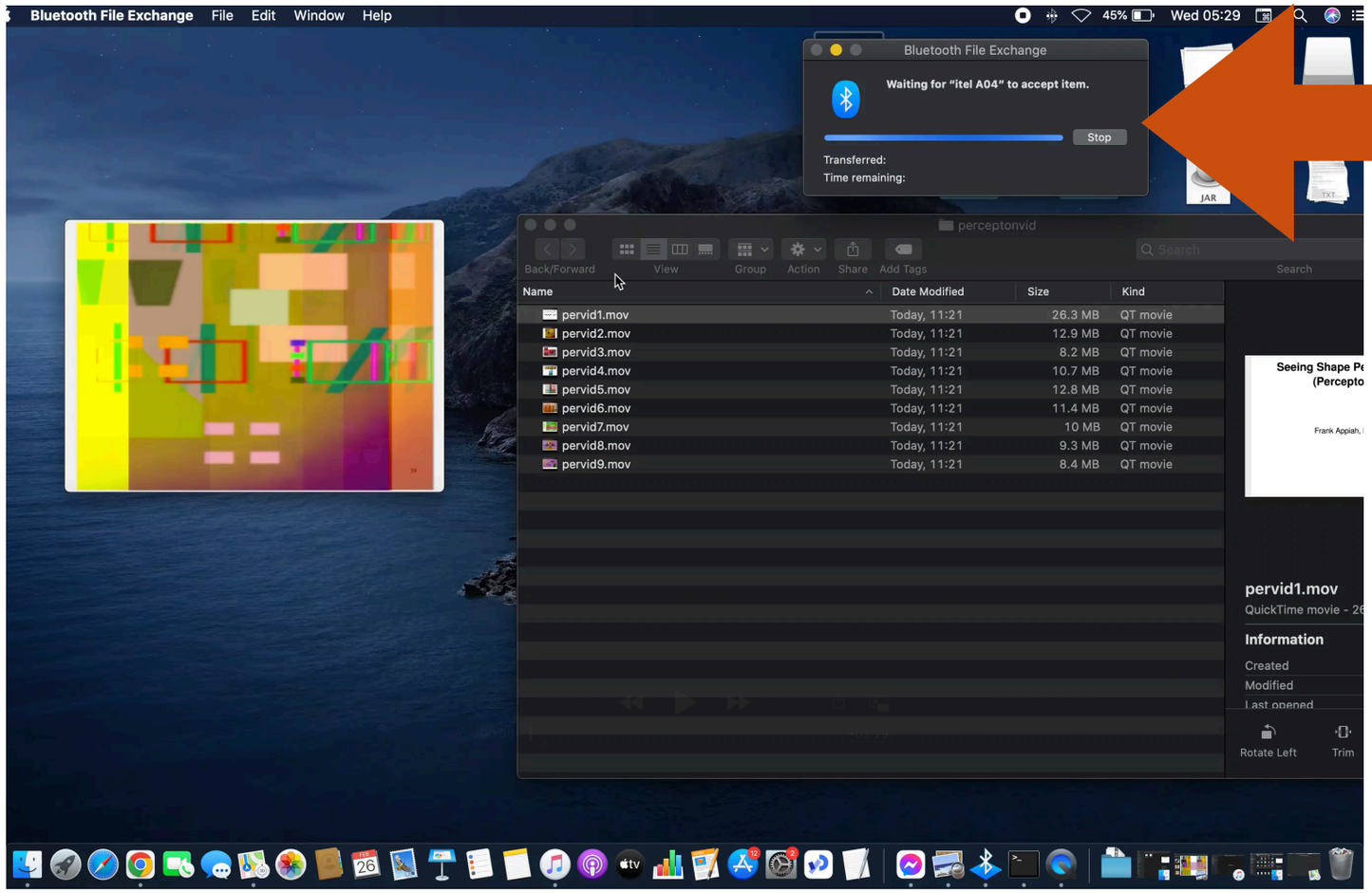
Next is the bluetooth file exchange views for the nine file transfer procedure.

Media Disc Information.





Total Size: 110 MB

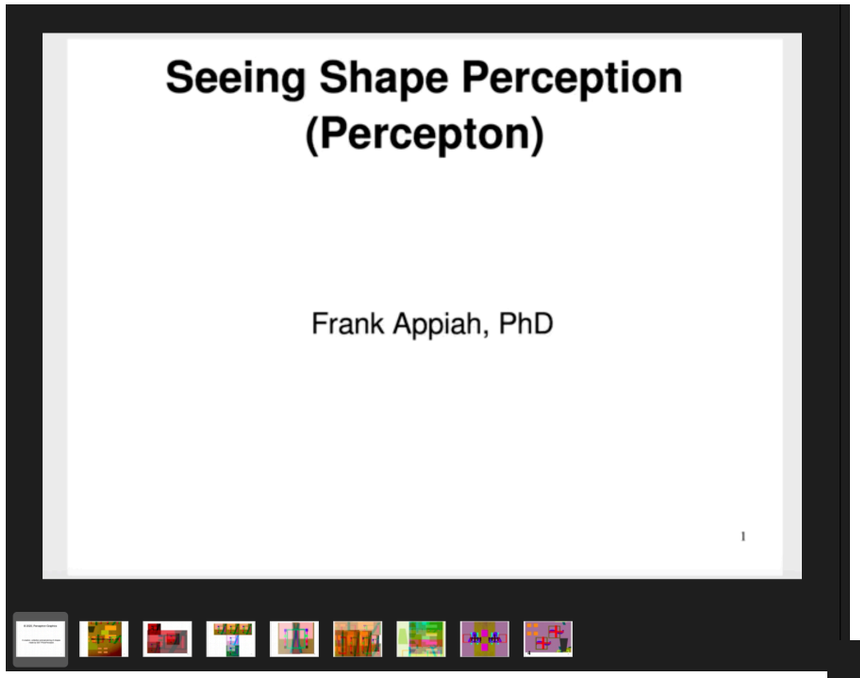


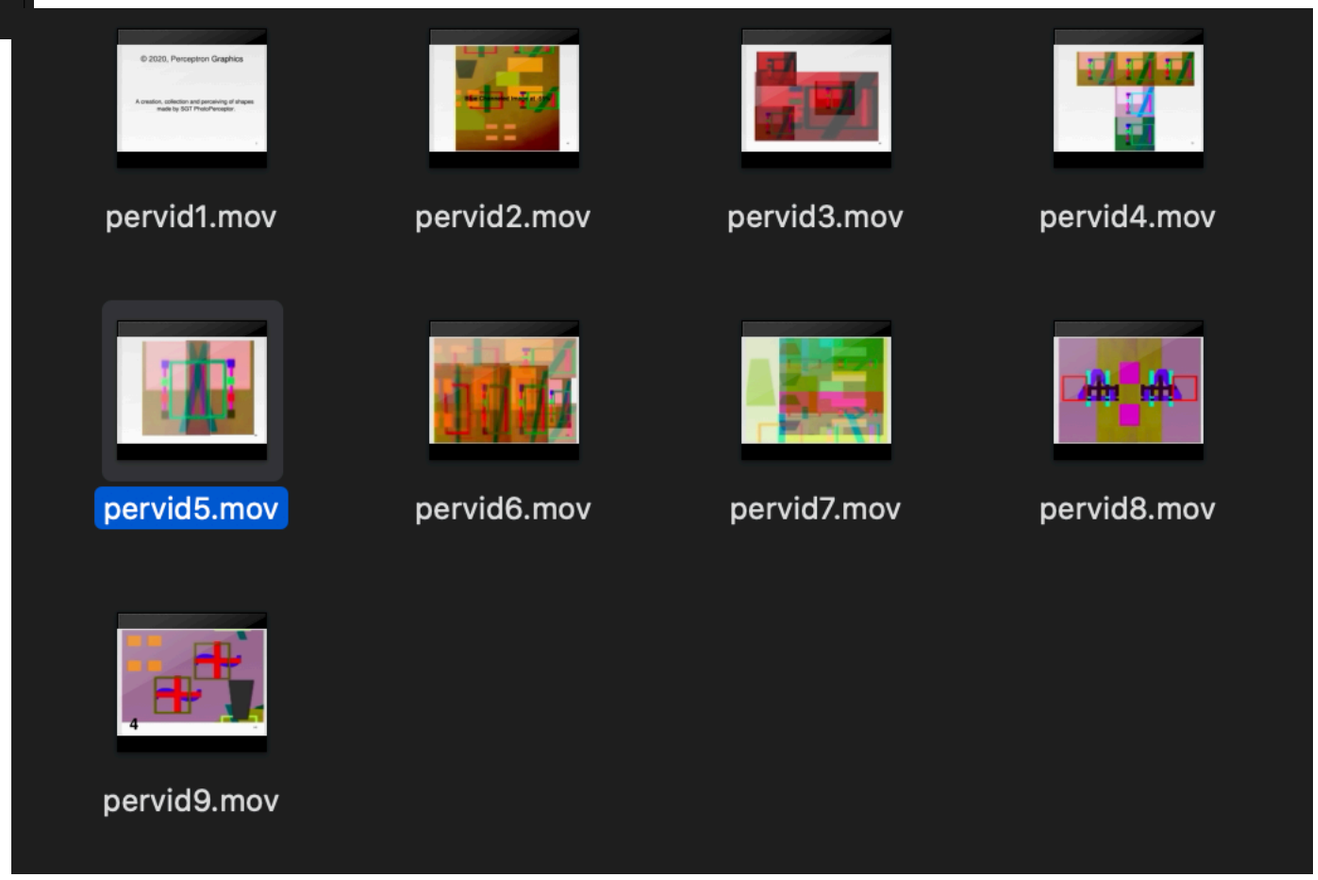
Bluetooth Exchange

Progress View.

3. Bluetooth Exchange View.

This section will show pictorial depictions off assumed file exchange via bluetooth between the the mobile device and the computer.

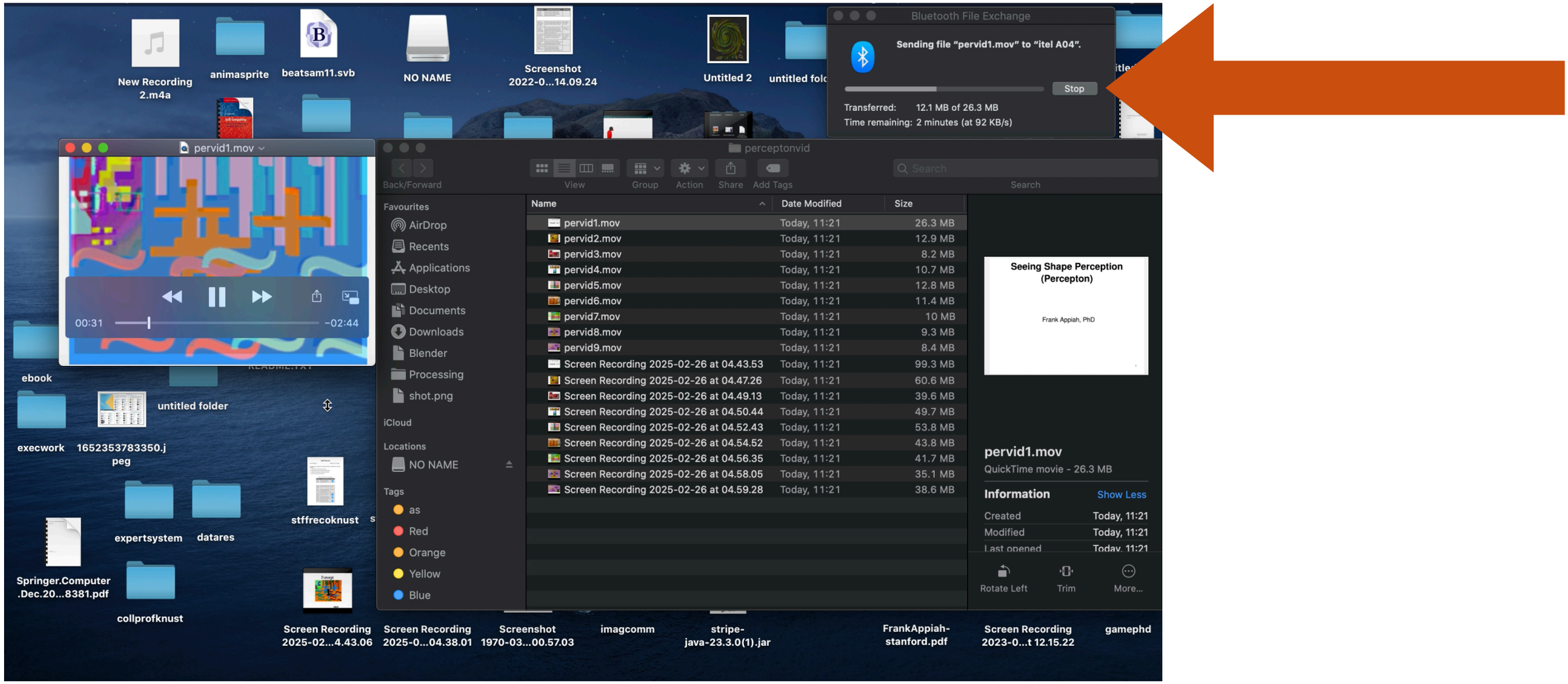

Seeing Shape Perception
(Percepton)
Frank Appiah, PhD
1


© 2020, Perceptron Graphics
A creation, collection and perceiving of shapes made by SGT PhotoPerceptor.
pervid1.mov
pervid2.mov
pervid3.mov
pervid4.mov
pervid5.mov
pervid6.mov
pervid7.mov
pervid8.mov
pervid9.mov

Bluetooth View

File Exchange Details .

- Media-Time vs Bluetooth-Time.
- Bluetooth Transfer Datarate.
- Data rate vs Transfer Time. [9 Points].
- Media Leading/Lagging Time vs Data Transfer Size [5 Points].



Media 1 Exchange View

S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading m/s	M-time Lagging m/s	B-Time m/s	Data Transfer Size (MB)	Data rate KB/s
3:59m	3s	3m	3.6	91
3:41m	21s	3m	5.3	87
3:27m	35s	3m	6.7	99
3:06m	56s	2m	8.8	95
2:47m	1:15m	2m	10.7	91
2:16m	1:46m	2m	13.7	93
2:09m	1:53m	1m	14.3	96
1:42m	2:20m	52s	17	86
6s	**3:56m**	**1s**	**26.3**	**96**

(M)edia-Time

vs

(B)luetooth-Time

Vs

Data Size

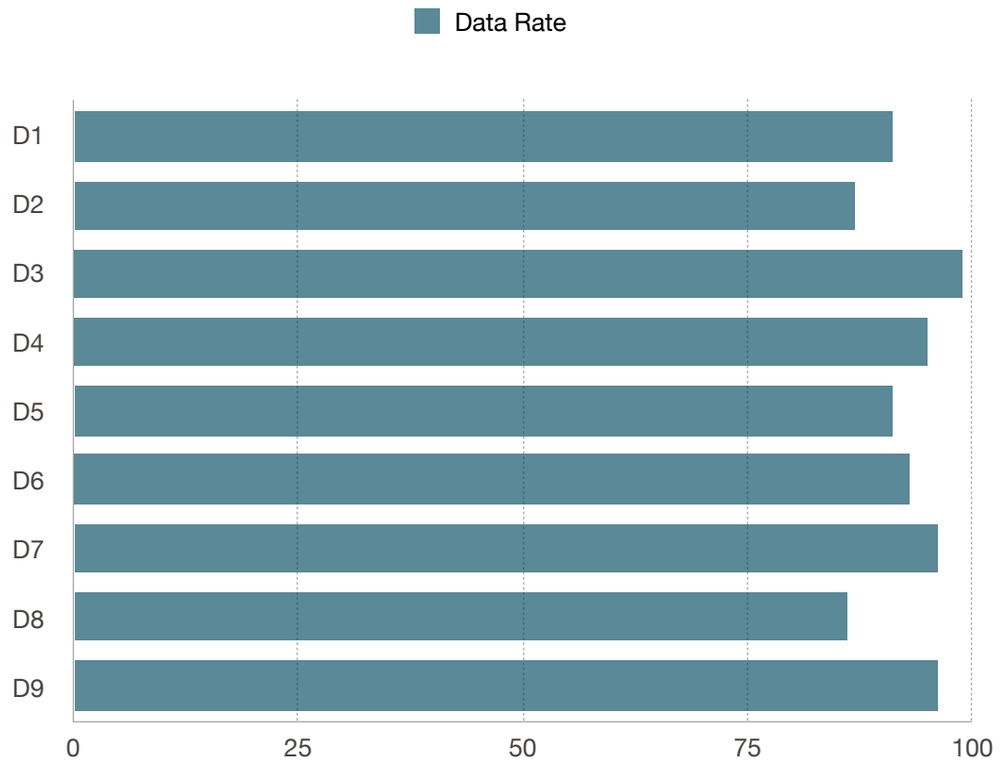
Media Exchange 1

The table provides the complete media timing sequence for media exchange 1. The video version for verifying data is uploaded to archive.org@frankappiah.

The studies on *media-time vs bluetooth-time* in green colour code. The study on *data transfer size vs data rate* is in yellow colour code. The third studies on *M-time vs Data transfer size*.

Statistics 1

Data rate(KB/s)
91
87
99
95
91
93
96
86
96

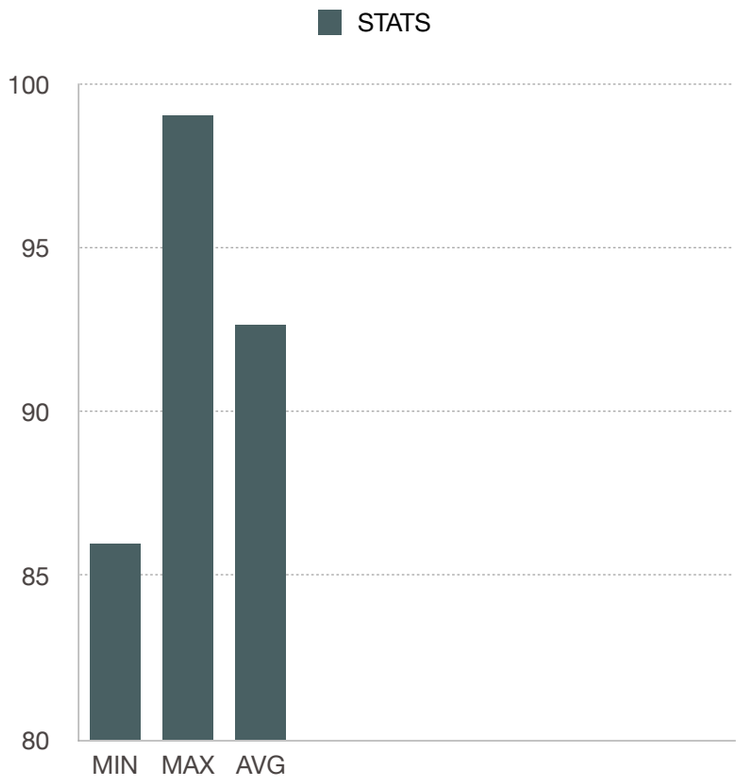


SUM:= 834

AVERAGE:=92.667

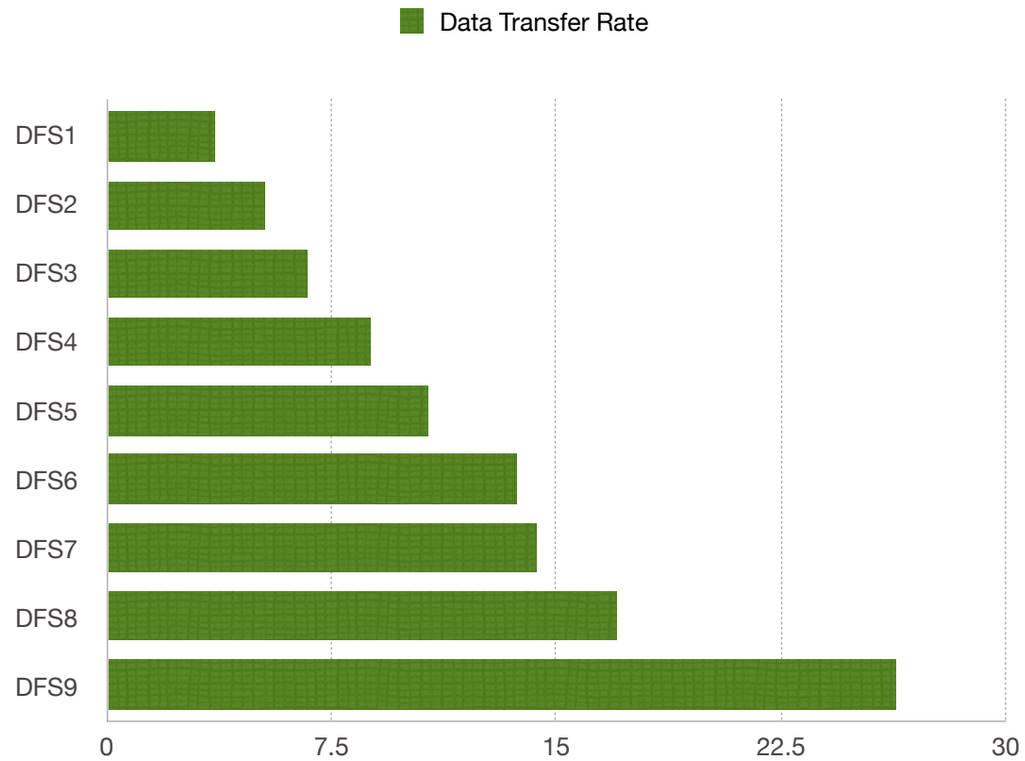
MIN:=86

MAX:=99



Statistics 1.1

Data transfer size(KB/s)
3.6
5.3
6.7
8.8
10.7
13.7
14.3
17
26.3

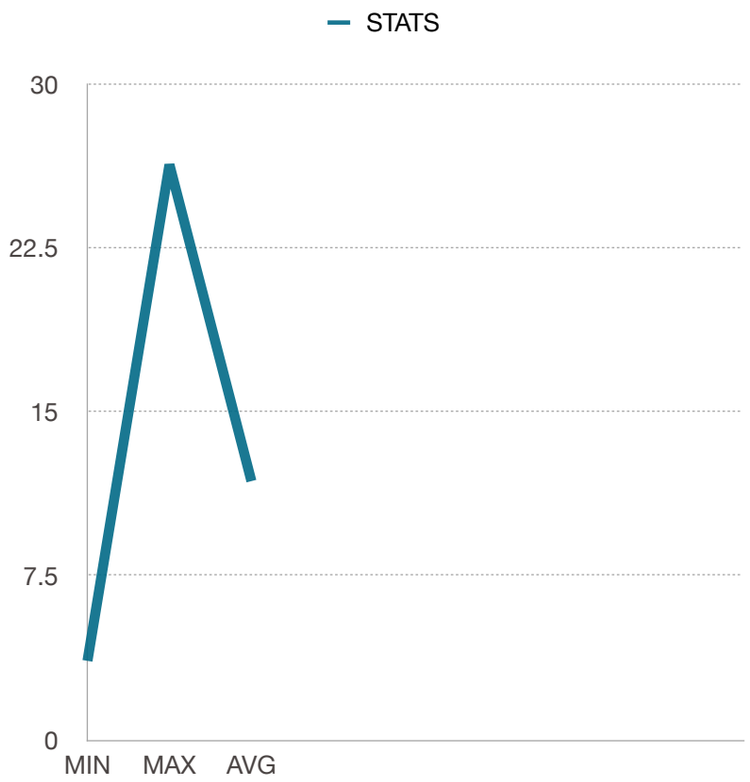


SUM:= 106.4

AVERAGE:=11.8222

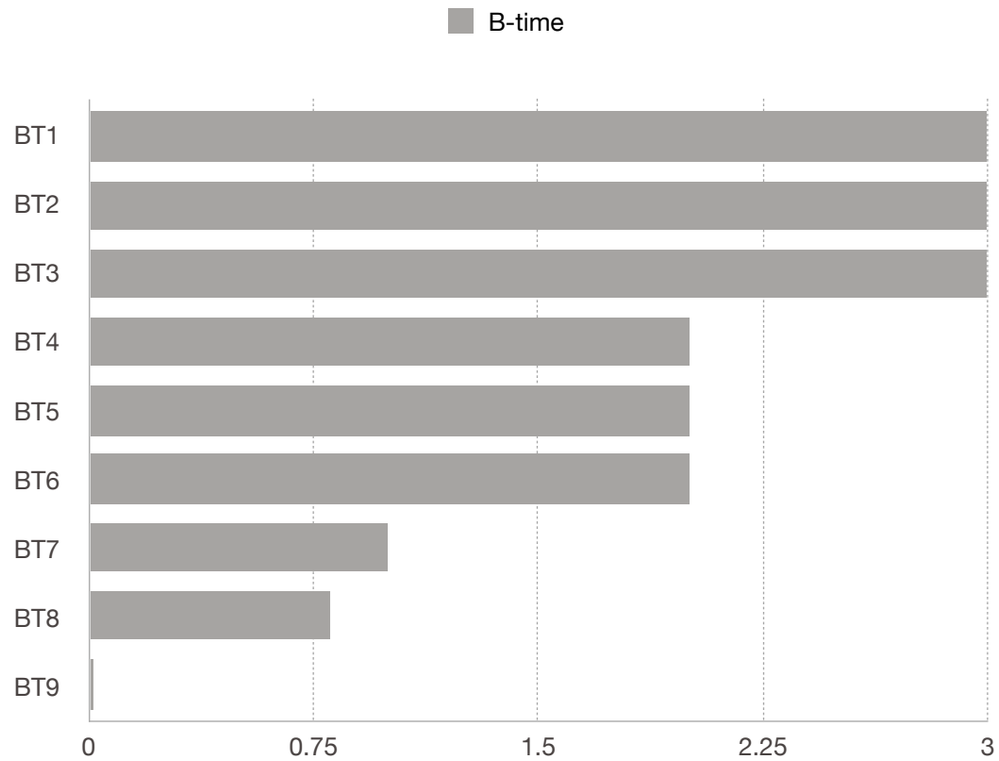
MIN:=3.6

MAX:=26.3



Statistics 1.2

B-time(m/s)
3m
3m
3m
2m
2m
2m
1m
52s
1s

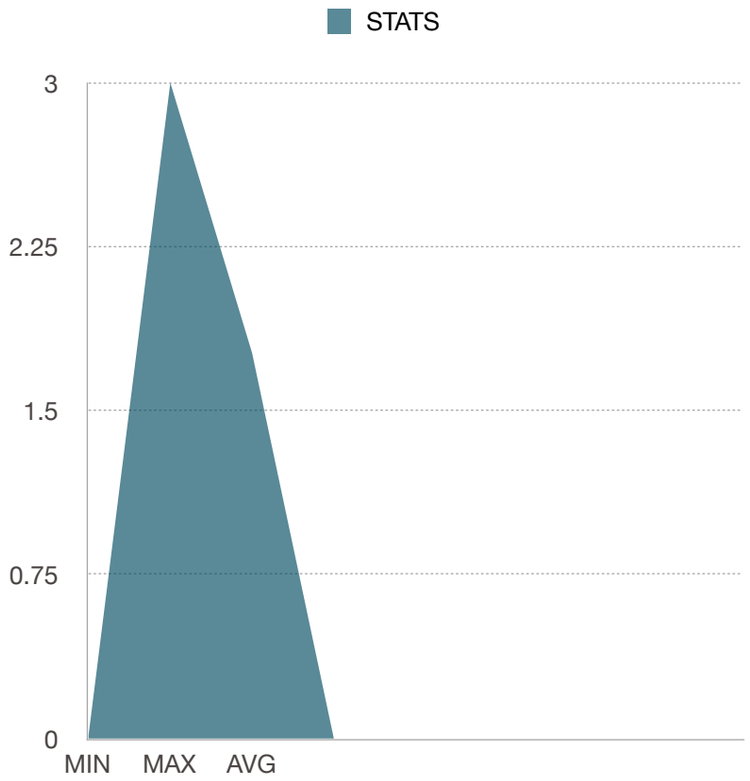


SUM:= 15.8826

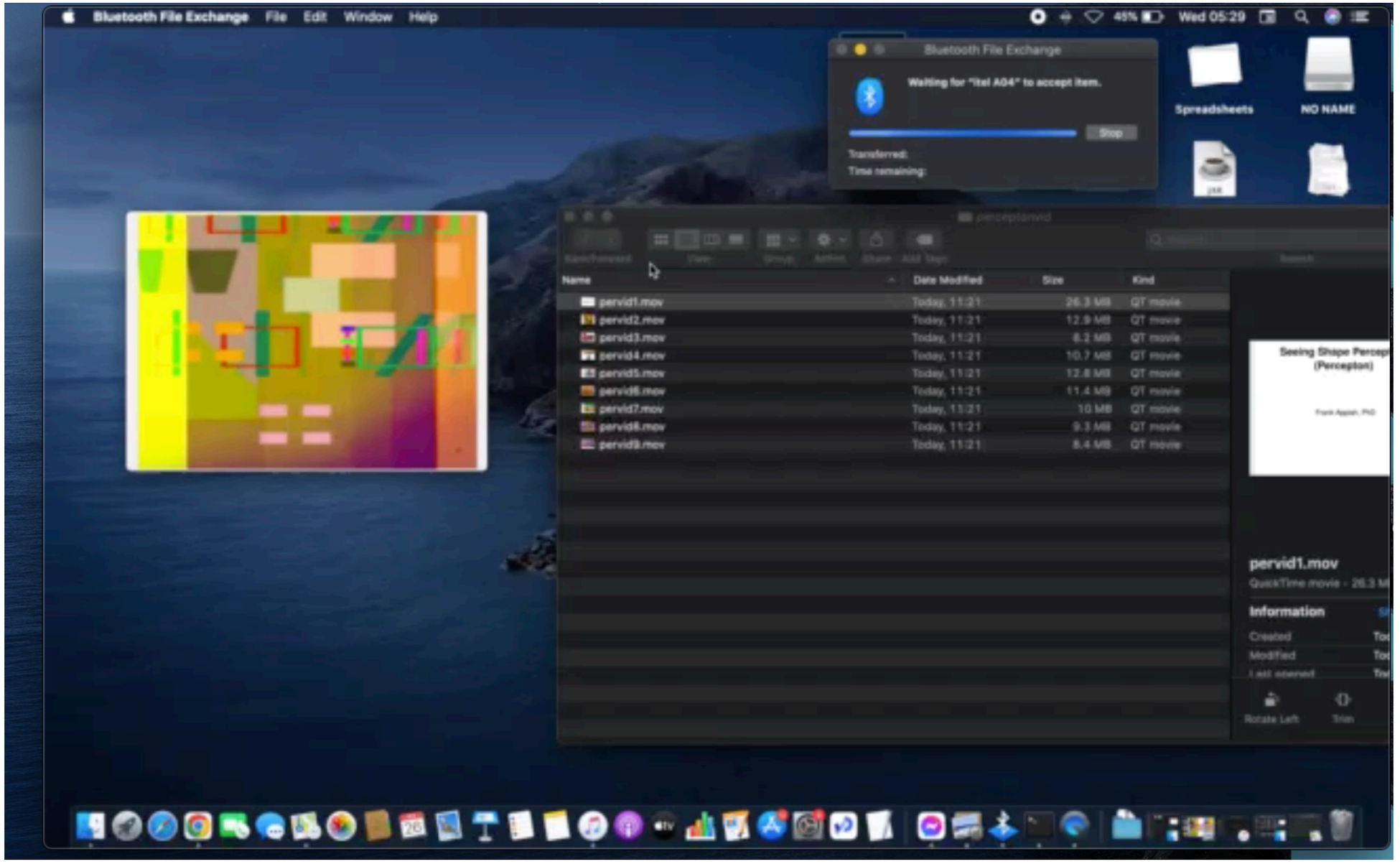
AVERAGE:=1.764

MIN:=0.016m

MAX:=3m



Media 2 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading m/s	M-time Lagging m/s	B-Time m/s	Data Transfer Size (MB)	Data rate KB/s
2:10m	19s	2m	1.1	82
2:06m	23s	1m	1.4	94
1:48m	41s	1m	3.0	94
1:41m	48s	1m	3.7	93
1:32m	57s	1m	4.5	92
1:05m	1:24m	1m	7.1	87
0:44m	1:45m	40s	9.1	92
0:20m	2:09m	20s	11.2	83
3s	**2:26m**	**1s**	**12.8**	**87**

(M)edia-Time

vs

(B)luetooth-Time

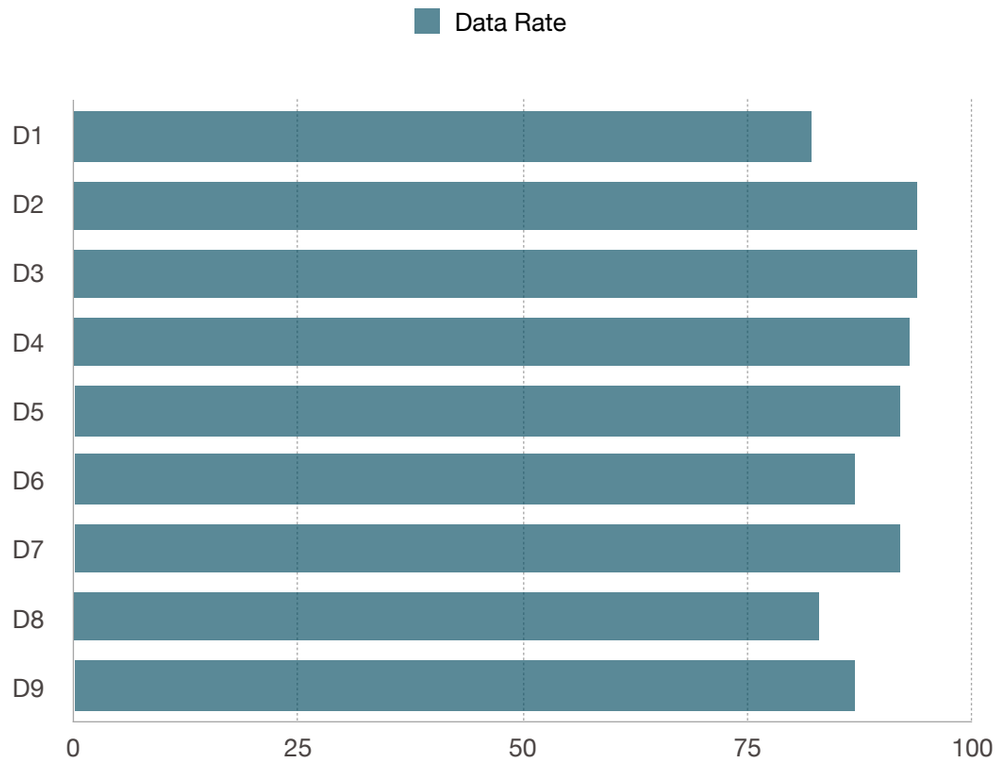
Vs

Data Size

The total file size is 12.9MB.

Statistics 2

Data rate(KB/s)
82
94
94
93
92
87
92
83
87

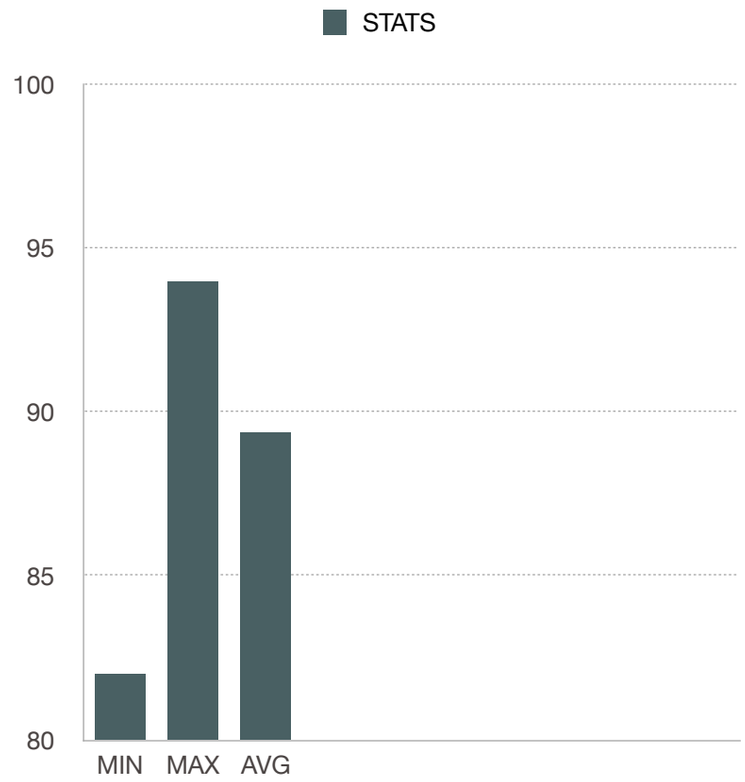


SUM:= 804

AVERAGE:=89.33

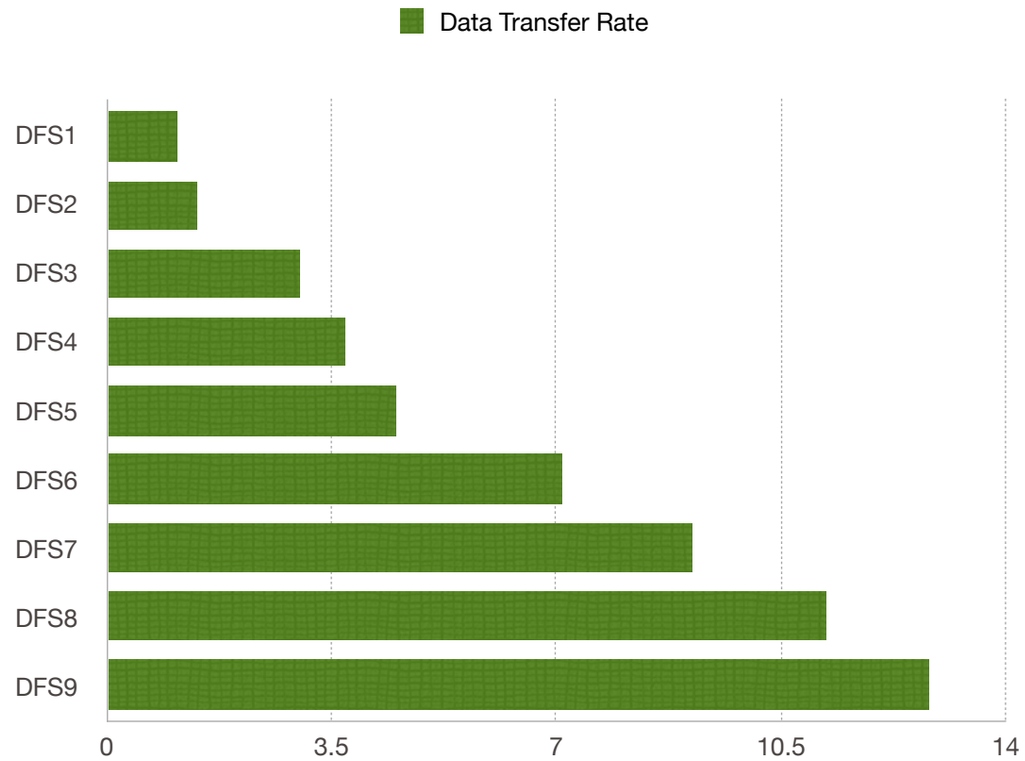
MIN:=82

MAX:=94



Statistics 2.1

Data transfer size(KB/s)
1.1
1.4
3.0
3.7
4.5
7.1
9.1
11.2
12.8

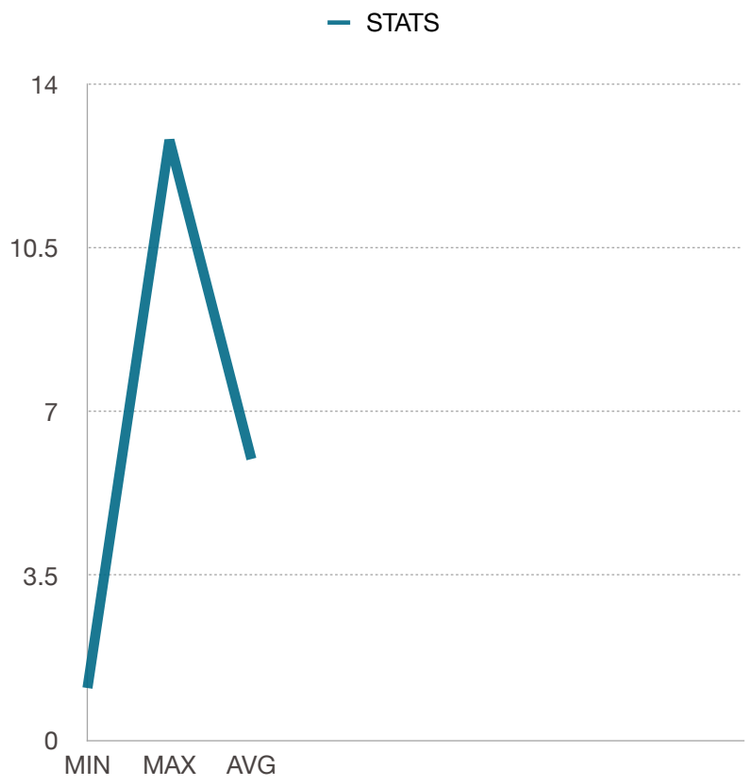


SUM:= 53.9

AVERAGE:=5.988

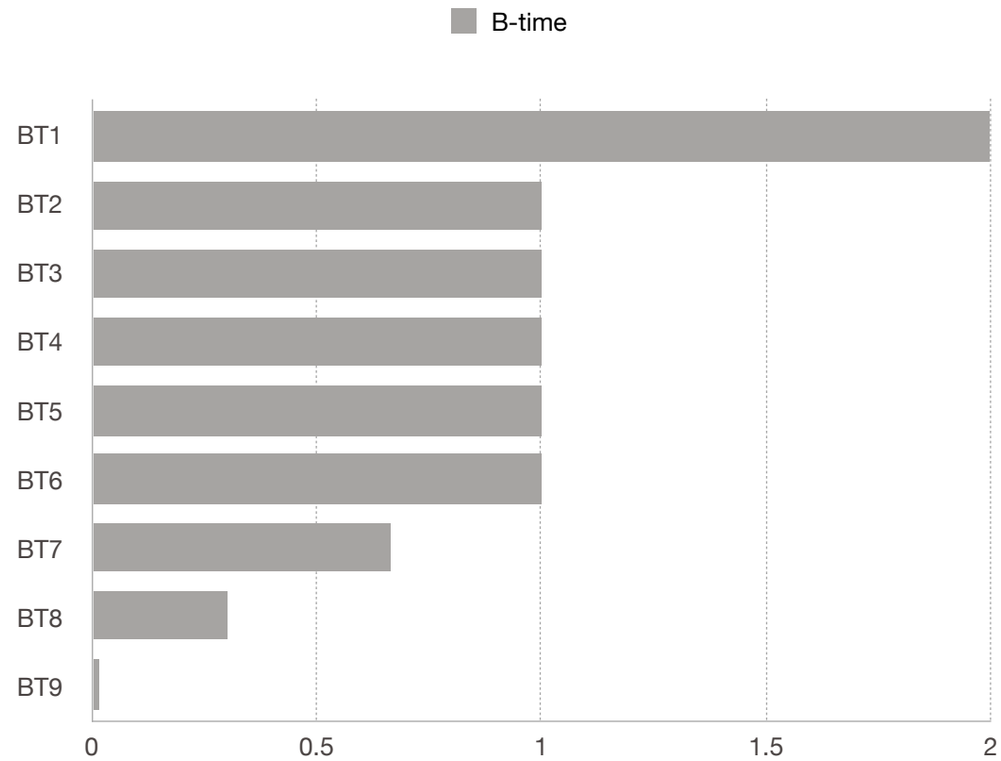
MIN:=1.1

MAX:=12.8



Statistics 2.2

B-time(m/s)
2m
1m
1m
1m
1m
1m
40s
20s
1s

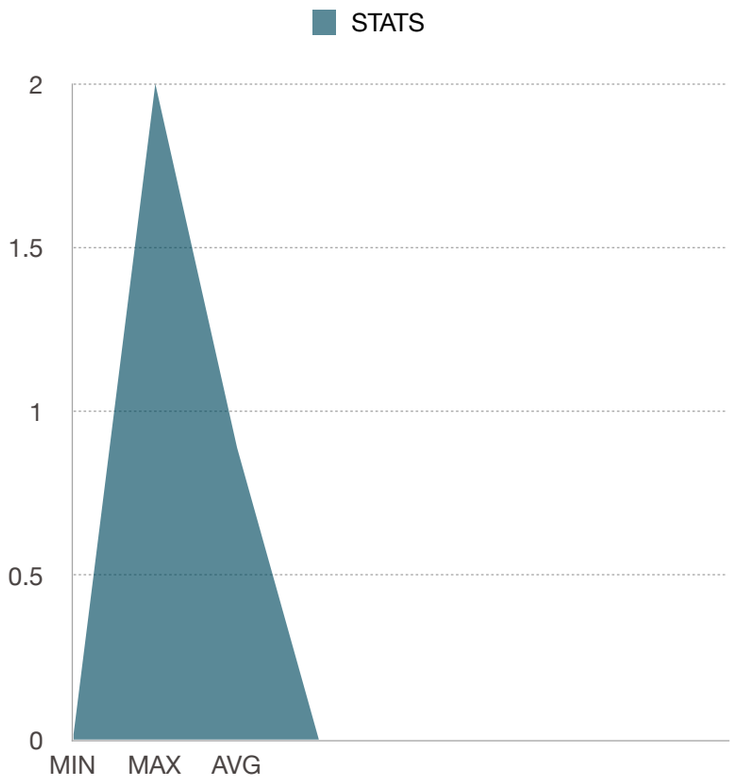


SUM:= 8.0167

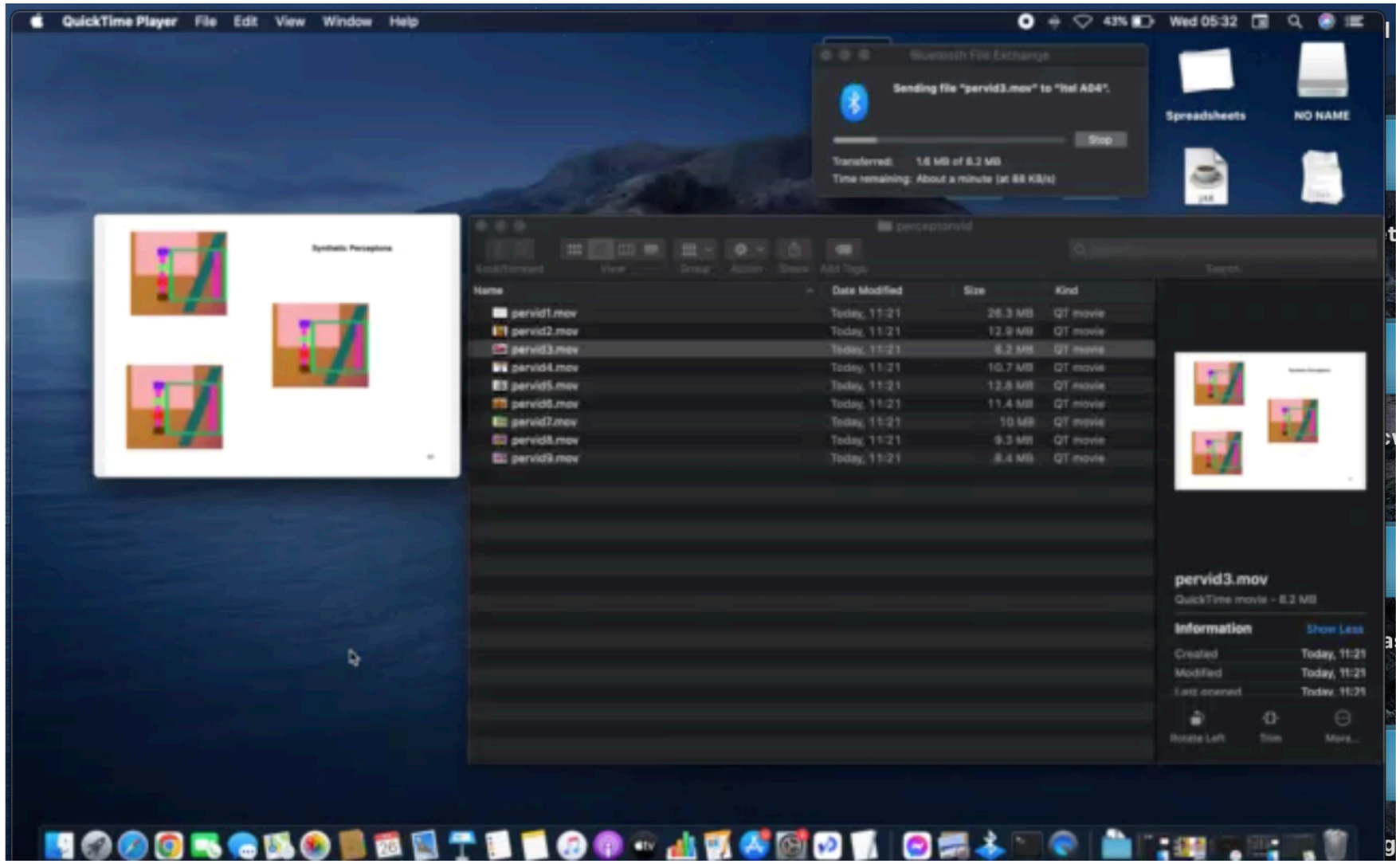
AVERAGE:=0.89

MIN:=0.016m

MAX:=2m



Media 3 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading m/s	M-time Lagging m/s	B-Time m/s	Data Transfer Size (MB)	Data rate KB/s
0:47s	19s	48s	4.2	83
0:44s	31s	43s	4.5	86
0:40s	35s	36s	4.8	92
0:40s	35s	23s	5.3	90
0:26s	49s	23s	6.1	93
0:17s	58s	14s	7.0	96
0:09s	1:06m	6s	7.7	89
0:08s	1:07m	1s	7.8	87
4s	**1:11m**	**1s**	**8.2**	**103**

(M)edia-Time

vs

(B)luetooth-Time

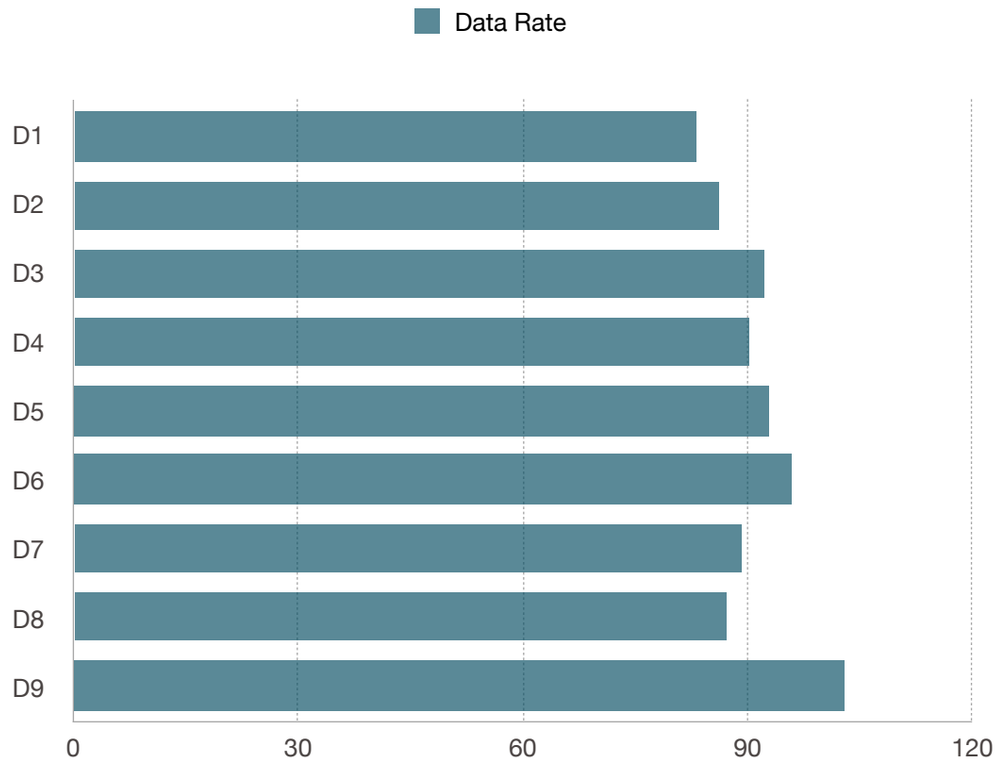
Vs

Data Size

The total file size is 8.2MB.

Statistics 3

Data rate(KB/s)
83
86
92
90
93
96
89
87
103

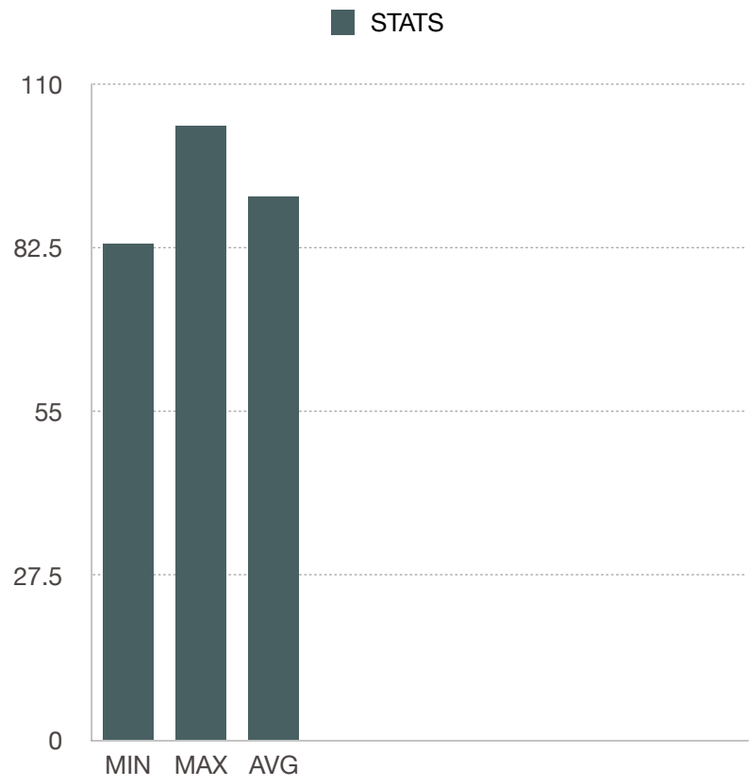


SUM:= 819

AVERAGE:=91

MIN:=83

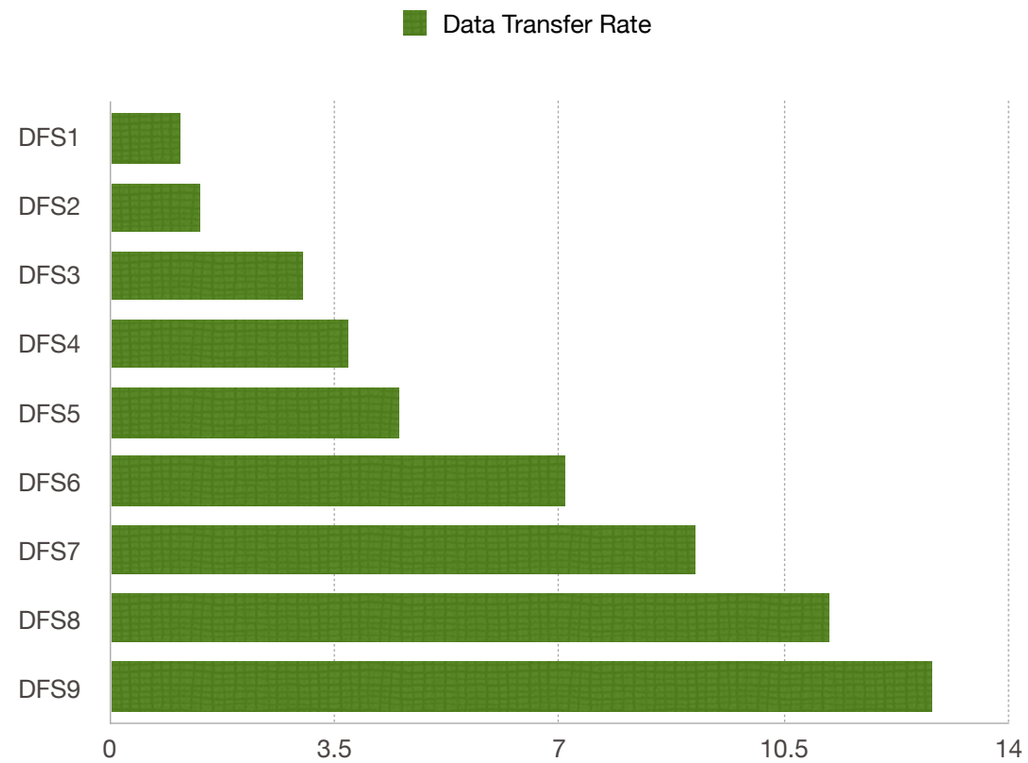
MAX:=103



Statistics 3.1

Data transfer size(KB/s)

4.2
4.5
4.8
5.3
6.1
7.0
7.7
7.8
8.2

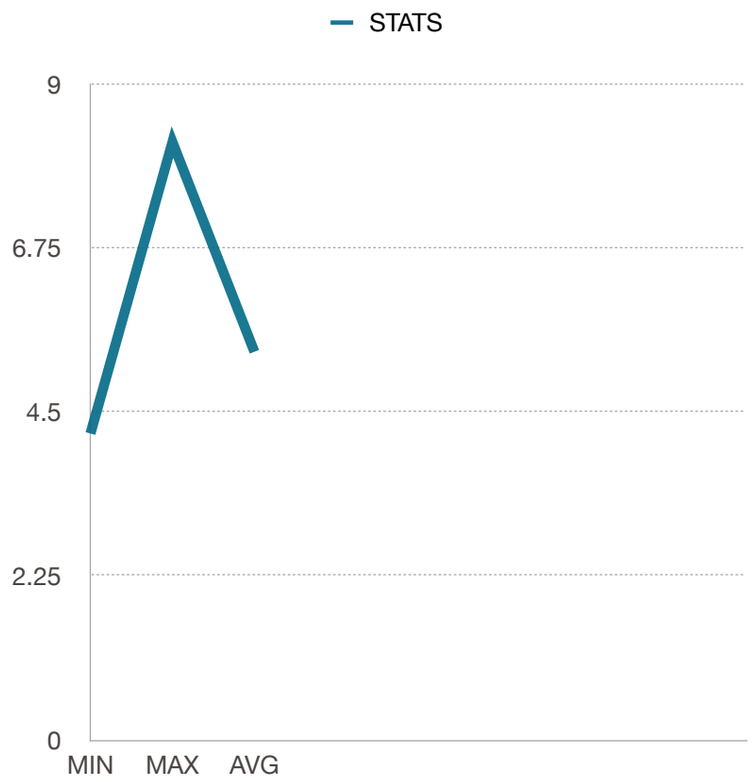


SUM:= 47.9

AVERAGE:=5.3222

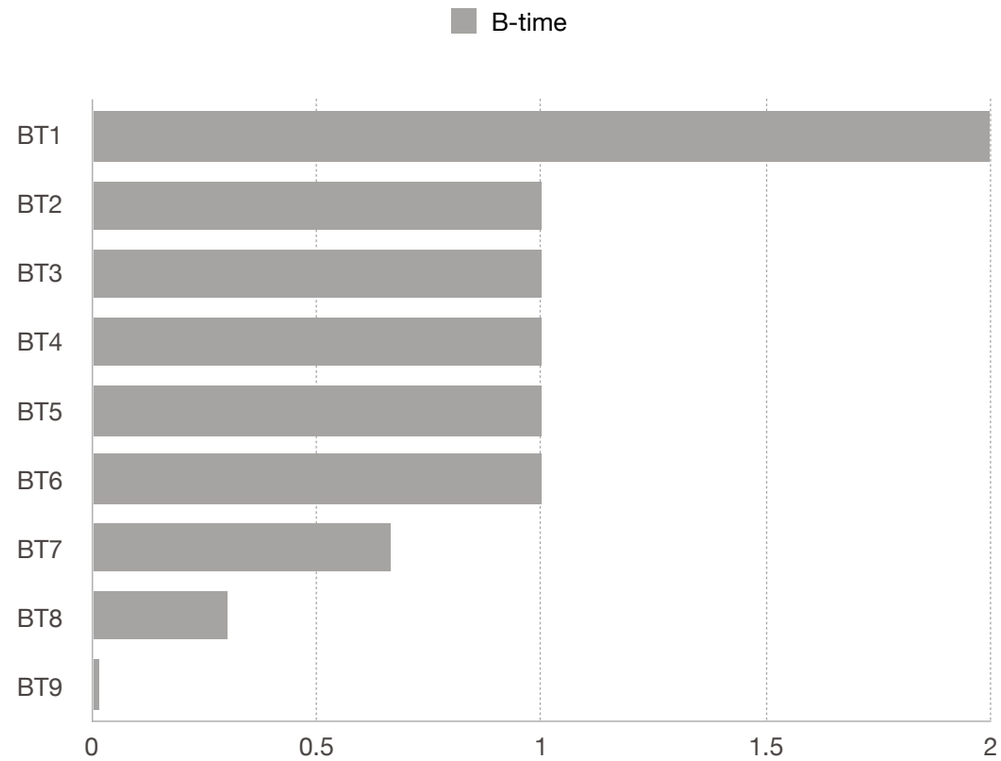
MIN:=4.2

MAX:=8.2



Statistics 3.2

B-time(m/s)
48s
43s
36s
23s
23s
14s
6s
1s
1s

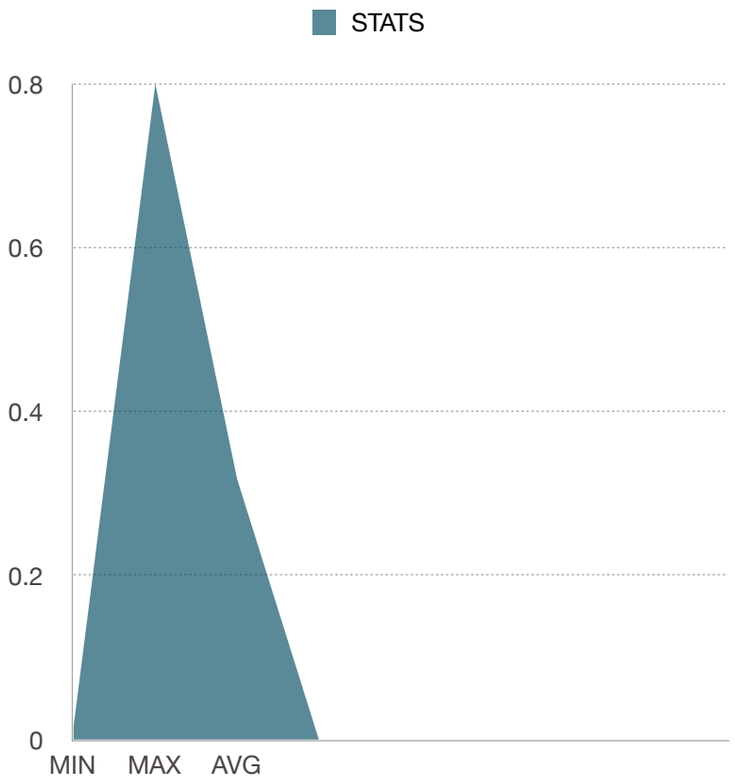


SUM:= 2.867

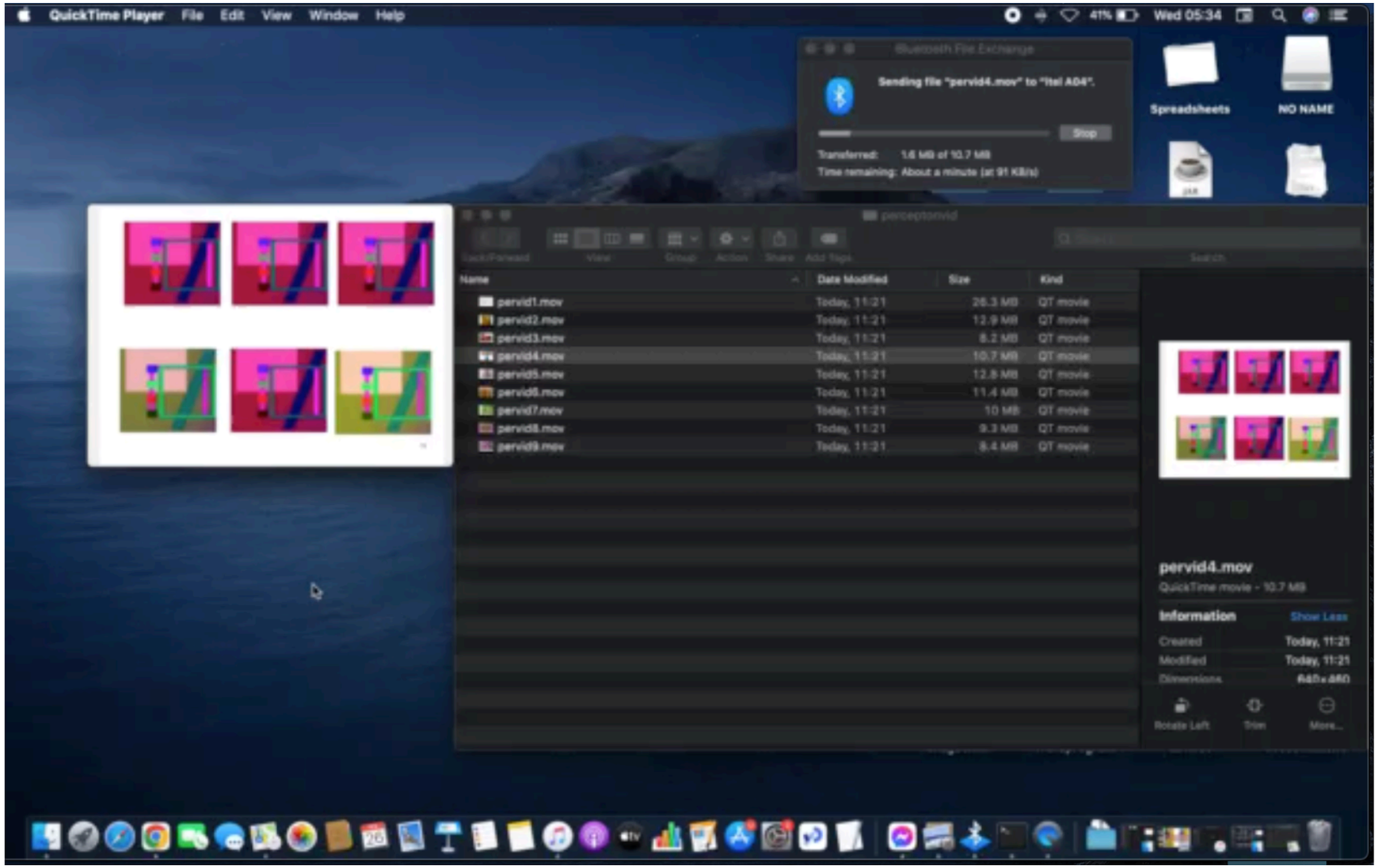
AVERAGE:=0.318

MIN:=0.016m

MAX:=0.8m



Media 4 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading s/m	M-time Lagging s/m	B-Time s/m	Data Transfer Size (MB)	Data rate KB/s
1:28m	23s	1m	3.8	92
1:15m	36s	1m	5.0	83
0:52s	59s	42s	7.2	83
0:42s	1:09m	31s	8.0	88
0:34s	1:17m	1m	8.8	88
1:05m	1:21m	40s	9.2	85
0:25s	1:26m	11s	9.4	97
0:21s	1:30m	20s	10	87
13s	**1:37m**	**1s**	**10.7**	**94**

(M)edia-Time

vs

(B)luetooth-Time

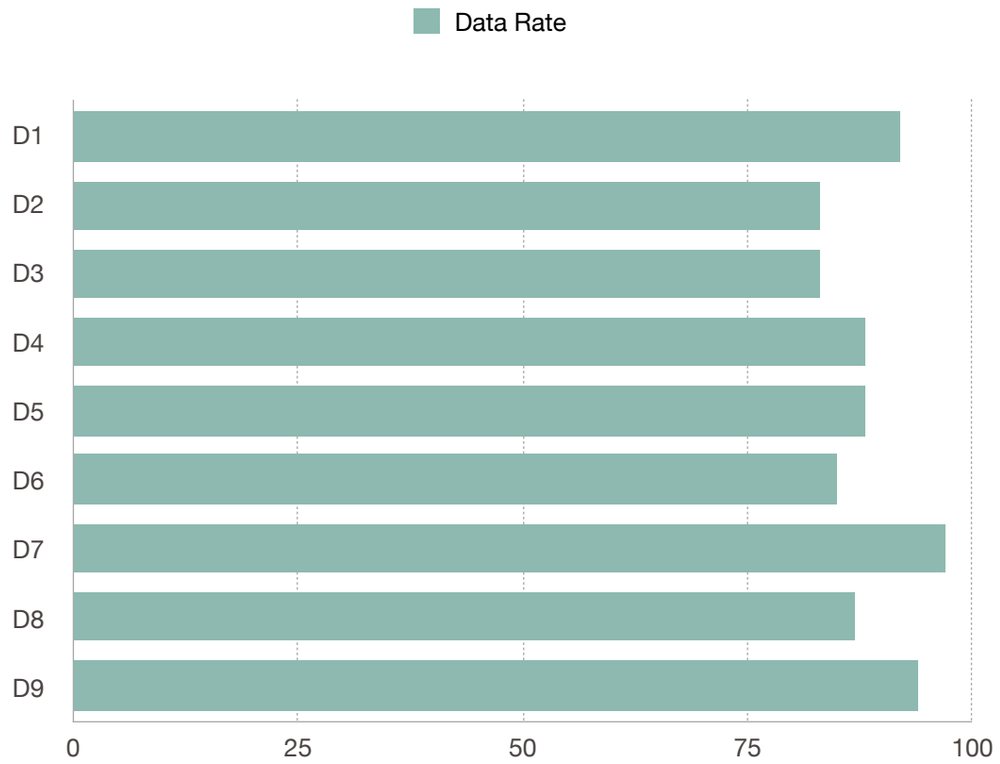
Vs

Data Size

The total file size is 10.7MB.

Statistics 4

Data rate(KB/s)
92
83
83
88
88
85
97
87
94

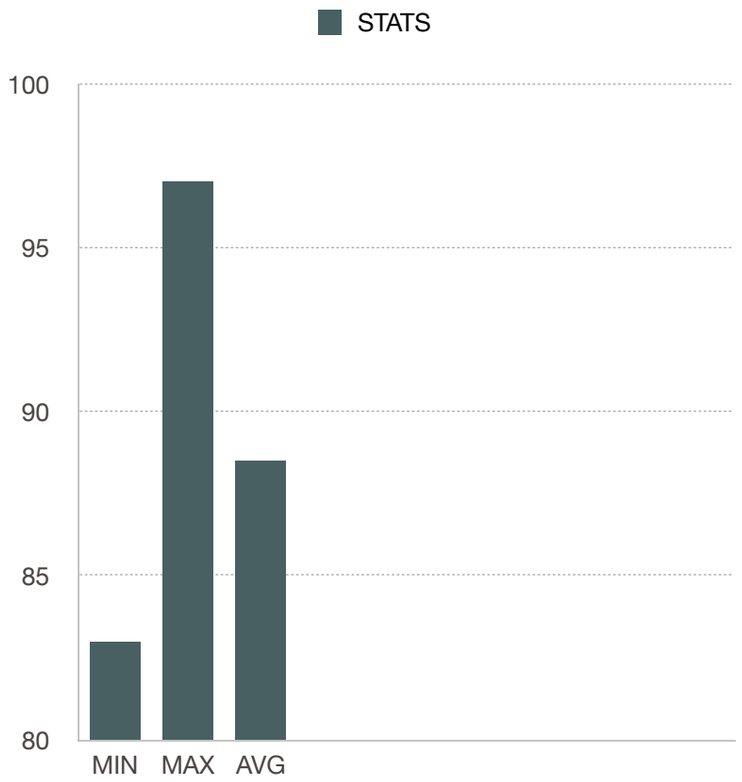


SUM:= 797

AVERAGE:=88.55

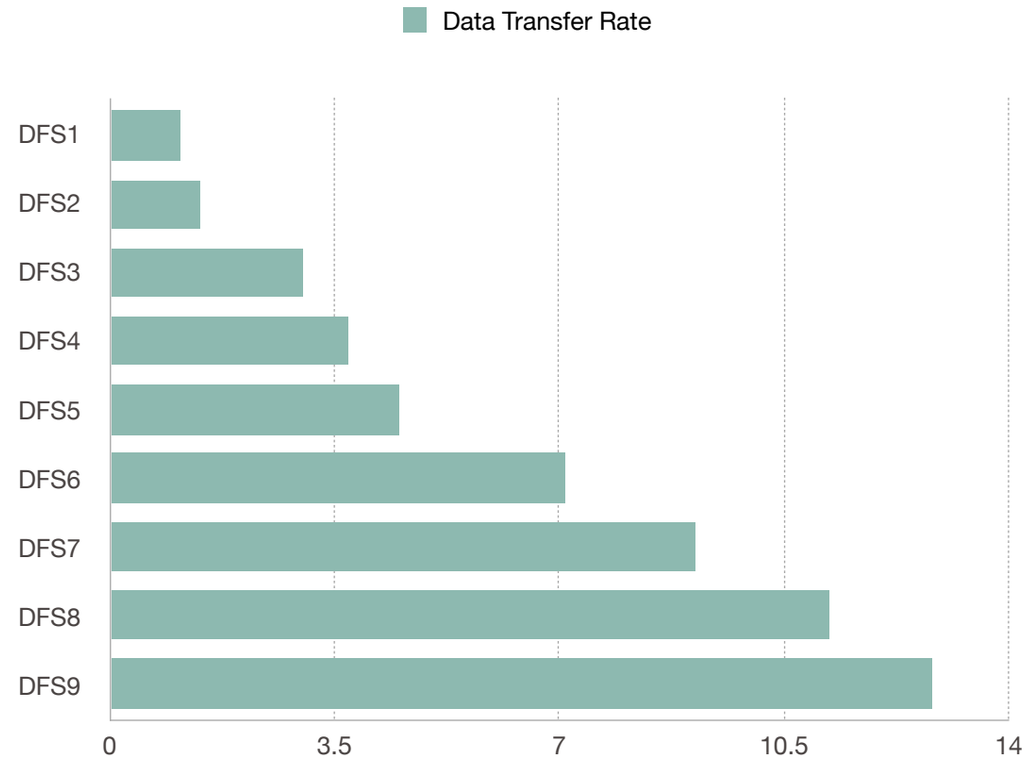
MIN:=83

MAX:=97



Statistics 4.1

Data transfer size(KB/s)
3.8
5.0
7.2
8.0
8.8
9.2
9.4
10
10.7

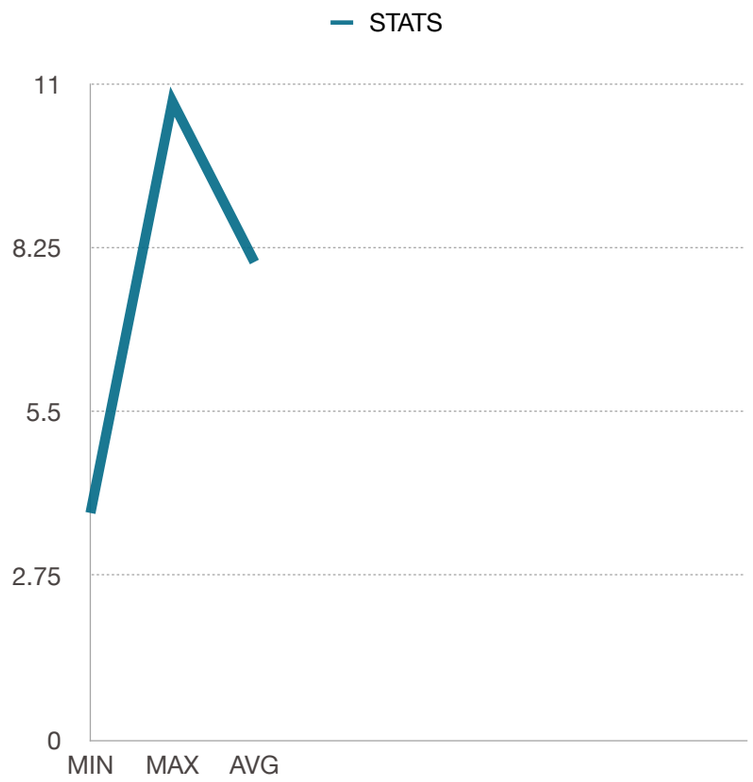


SUM:= 72.1

AVERAGE:=8.01

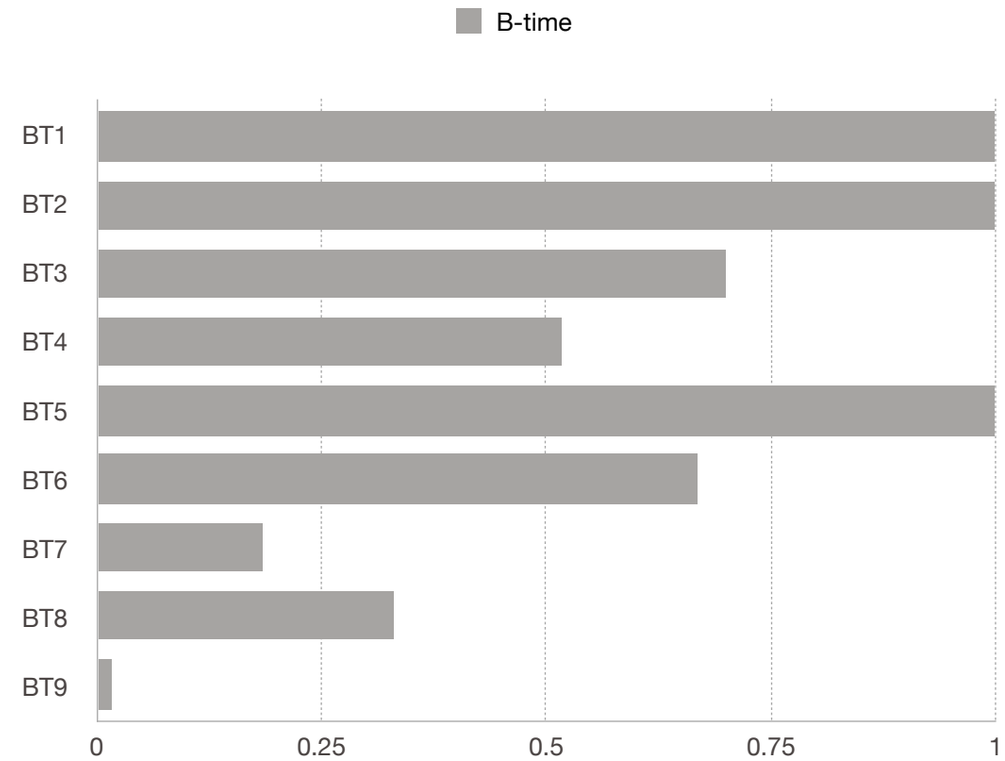
MIN:=3.8

MAX:=10.7



Statistics 4.2

B-time(m/s)
1m
1m
42s
31s
1m
40s
11s
20s
1s

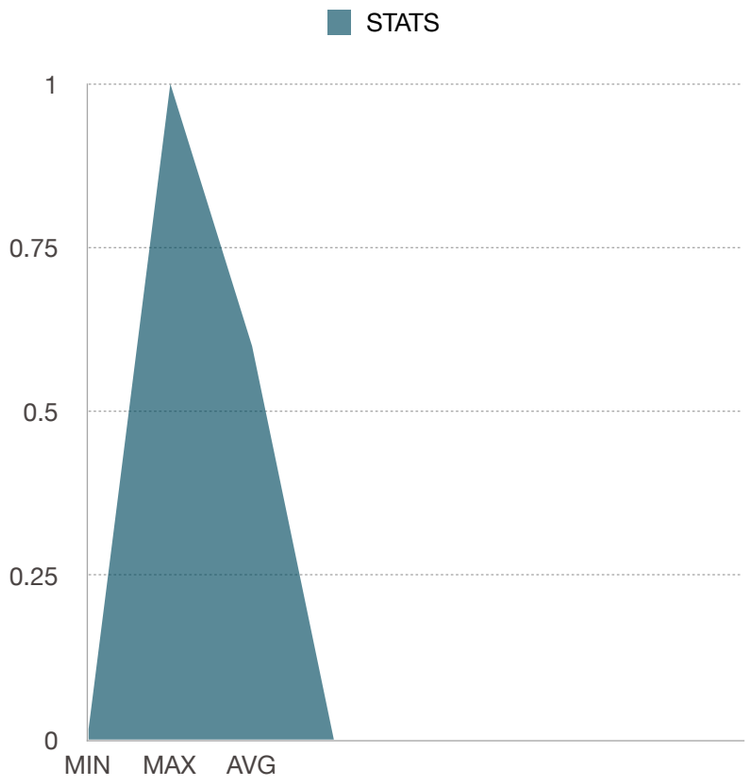


SUM:= 5.415

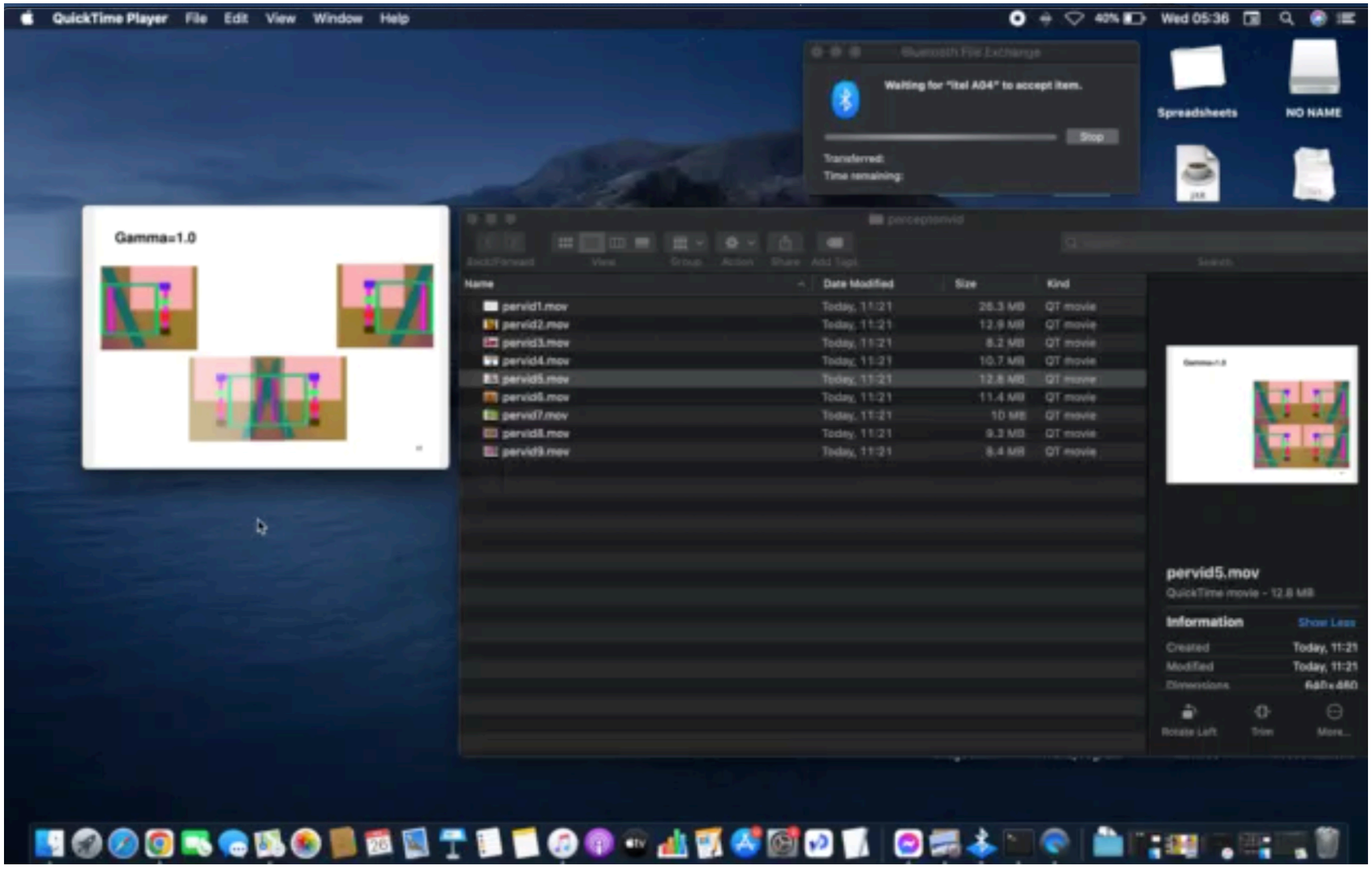
AVERAGE:=0.601

MIN:=0.016m

MAX:=1m



Media 5 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading s/m	M-time Lagging s/m	B-Time s/m	Data Transfer Size (MB)	Data rate KB/s
2:10m	19s	2m	1.1	82
2:06m	23s	1m	1.4	94
1:48m	41s	1m	3.0	94
1:41m	48s	1m	3.7	93
1:32m	57s	1m	4.5	92
1:05m	1:24m	1m	7.1	87
0:44m	1:45m	40s	9.1	92
0:20m	2:09m	20s	11.2	83
3s	**2:26m**	**1s**	**12.8**	**87**

(M)edia-Time

vs

(B)luetooth-Time

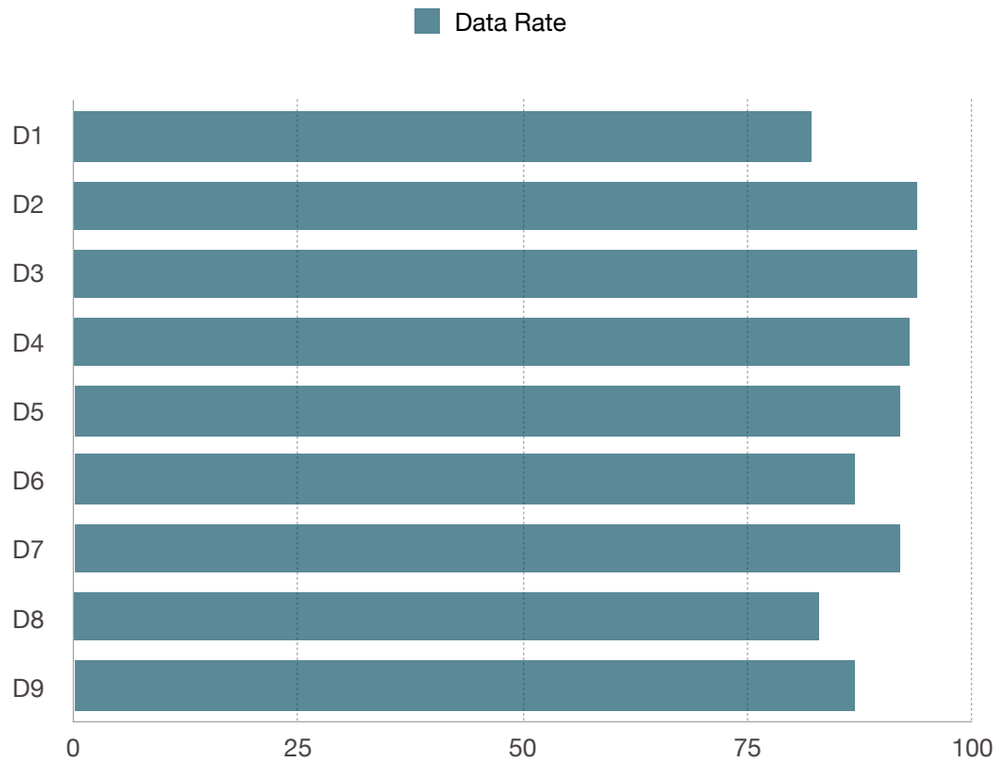
Vs

Data Size

The total file size is 12.8MB.

Statistics 5

Data rate(KB/s)
82
94
94
93
92
87
92
83
87

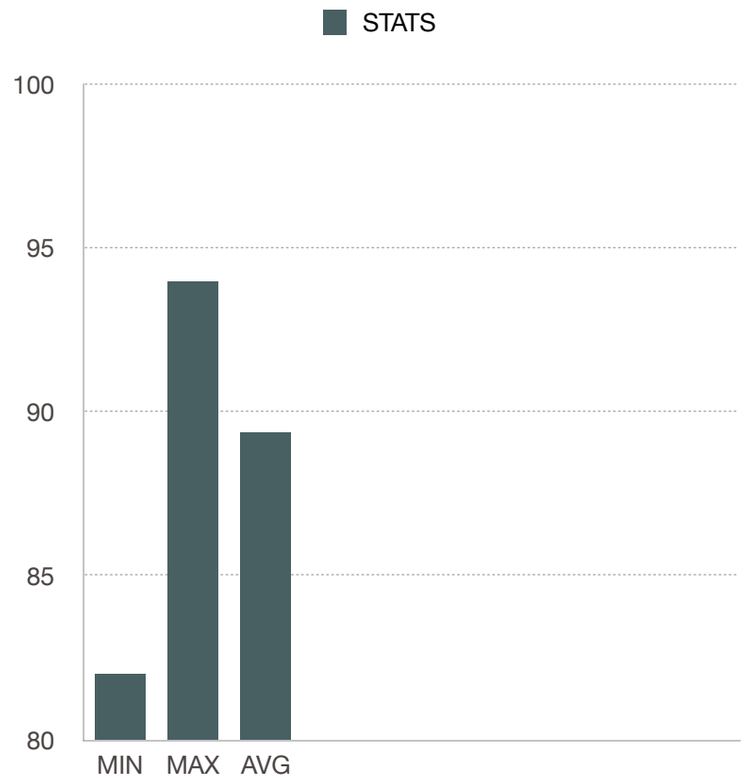


SUM:= 804

AVERAGE:=89.33

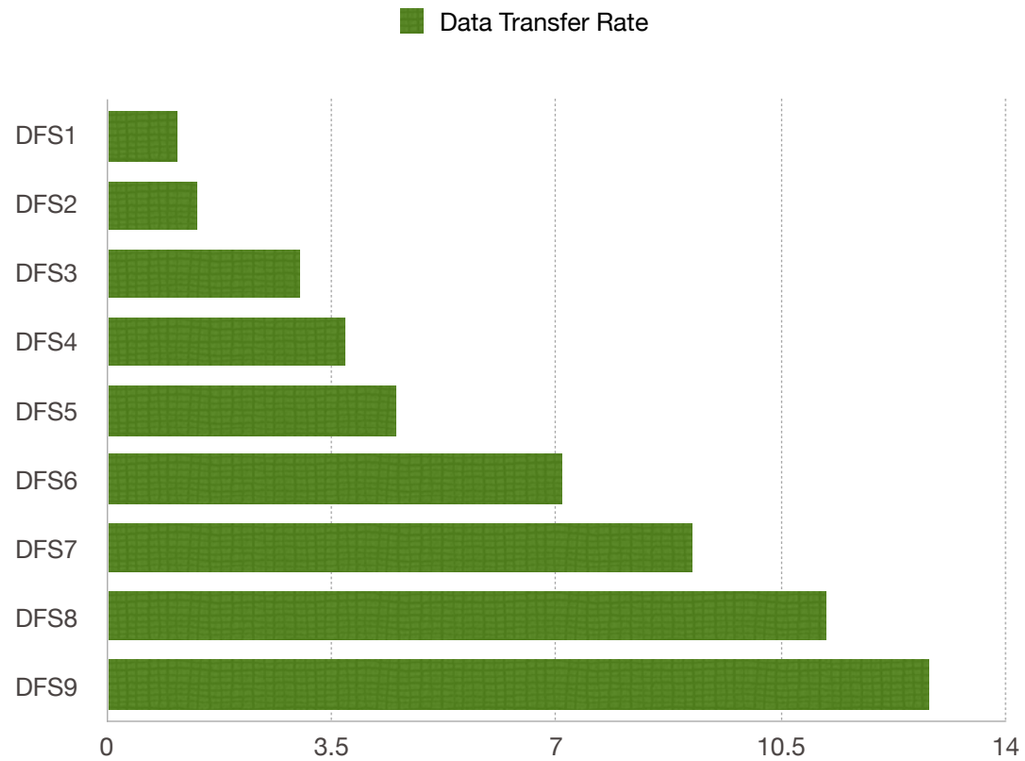
MIN:=82

MAX:=94



Statistics 5.1

Data transfer size(KB/s)
1.1
1.4
3.0
3.7
4.5
7.1
9.1
11.2
12.8

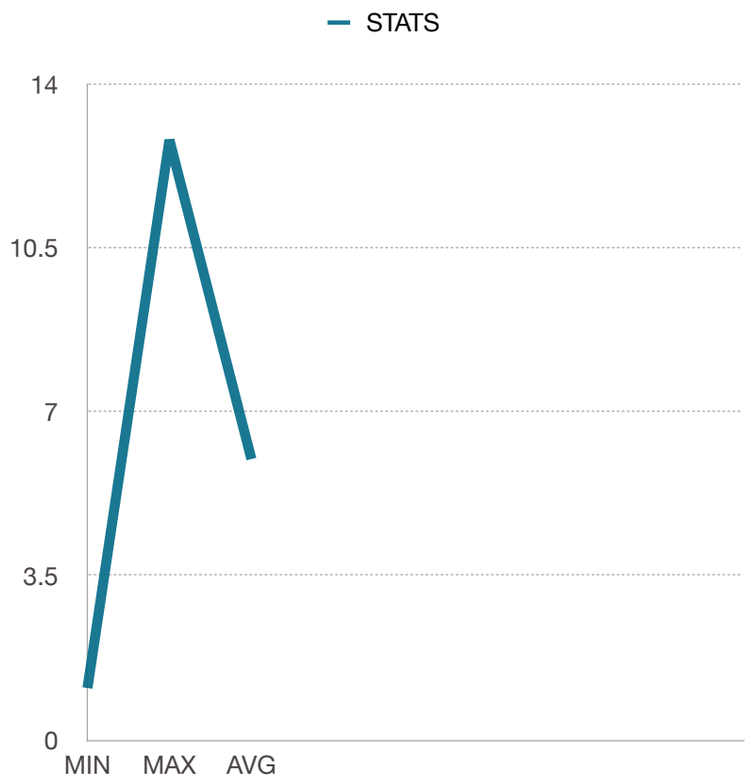


SUM:= 53.9

AVERAGE:=5.988

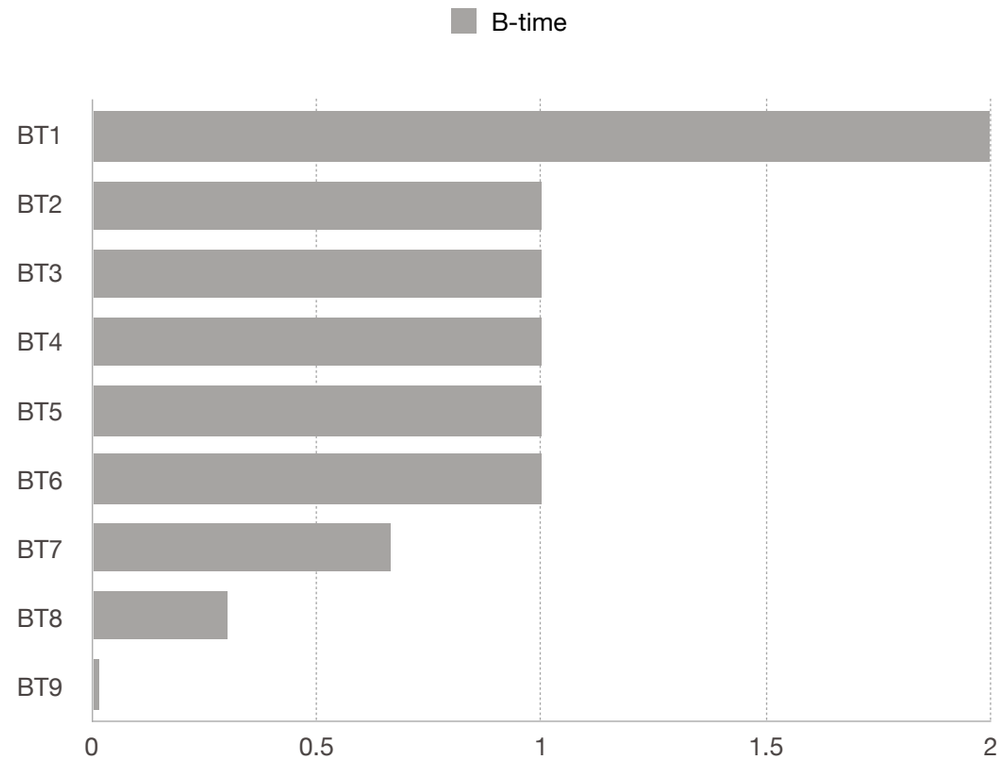
MIN:=1.1

MAX:=12.8



Statistics 5.2

B-time(m/s)
2m
1m
1m
1m
1m
1m
40s
20s
1s

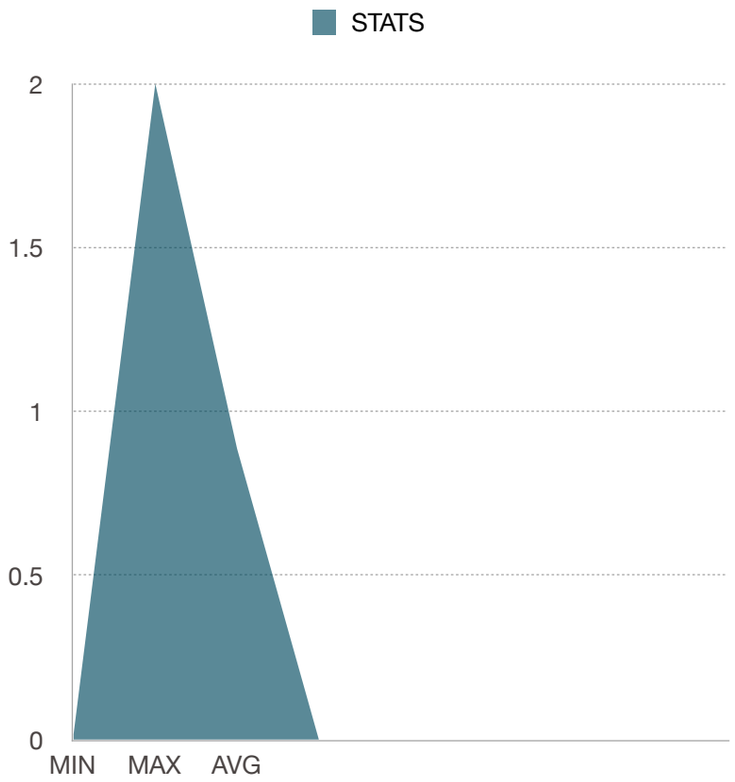


SUM:= 7.983

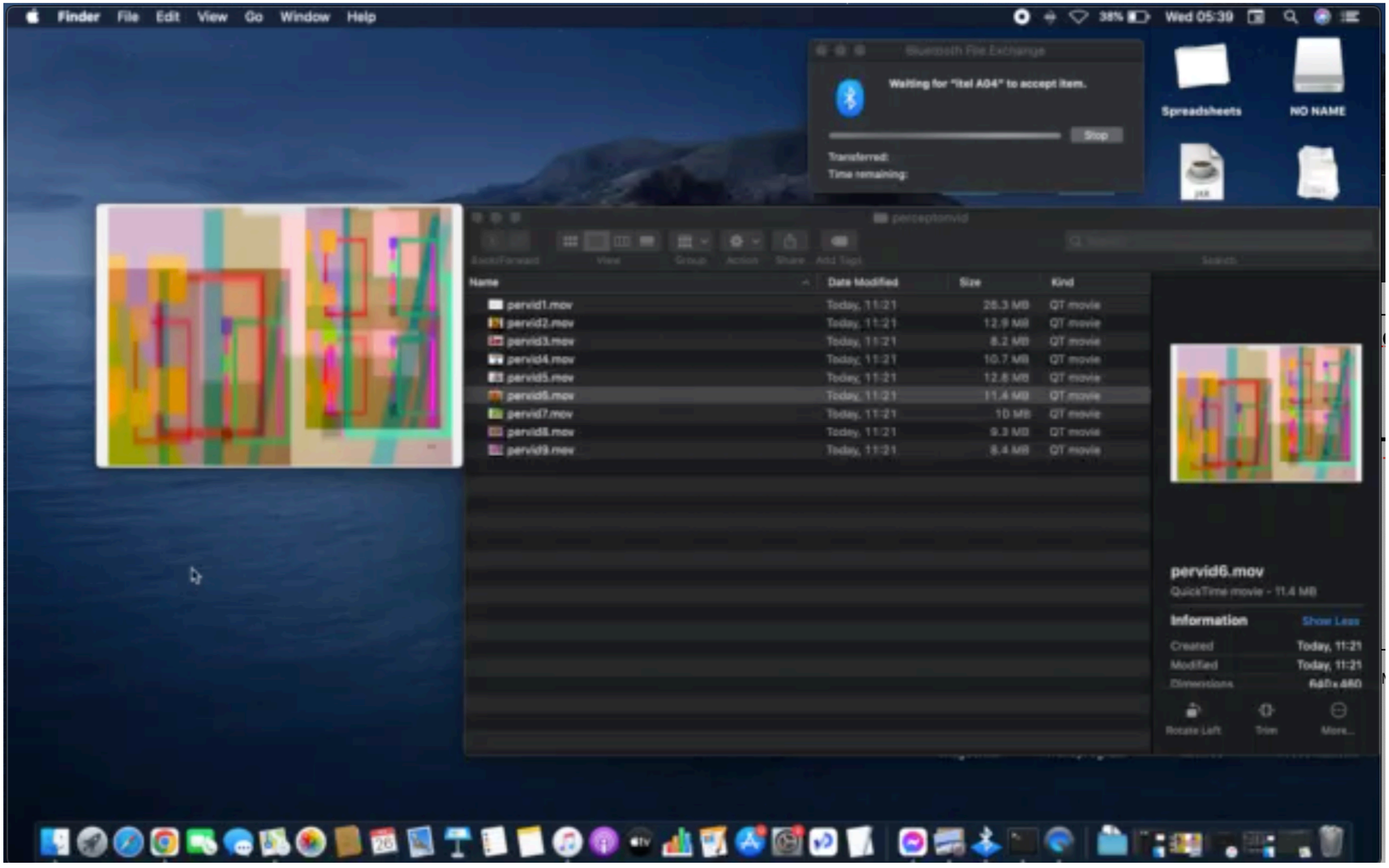
AVERAGE:=0.887

MIN:=0.016m

MAX:=2m



Media 6 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading s/m	M-time Lagging s/m	B-Time s/m	Data Transfer Size (MB)	Data rate KB/s
1:42m	26s	1m	2.2	92
1:16m	52s	1m	4.7	94
0:58s	1:10m	1m	6.3	92
48s	1:28m	43s	7.3	91
31s	1:37m	27s	8.8	90
22s	1:46m	10s	9.4	93
15s	1:53m	40s	10.2	90
0:20m	2:01m	5s	11	90
3s	**2:05m**	**1s**	**11.4**	**96**

(M)edia-Time

vs

(B)luetooth-Time

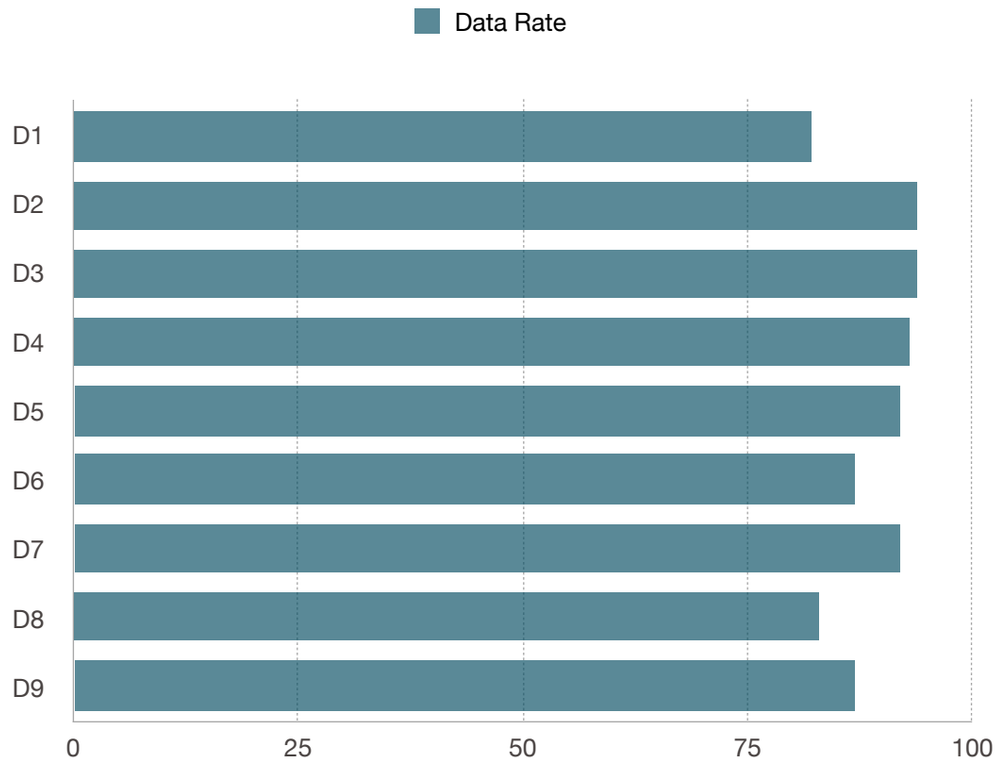
Vs

Data Size

The total file size is 11.4MB.

Statistics 6

Data rate(KB/s)
92
94
92
91
90
93
90
90
96

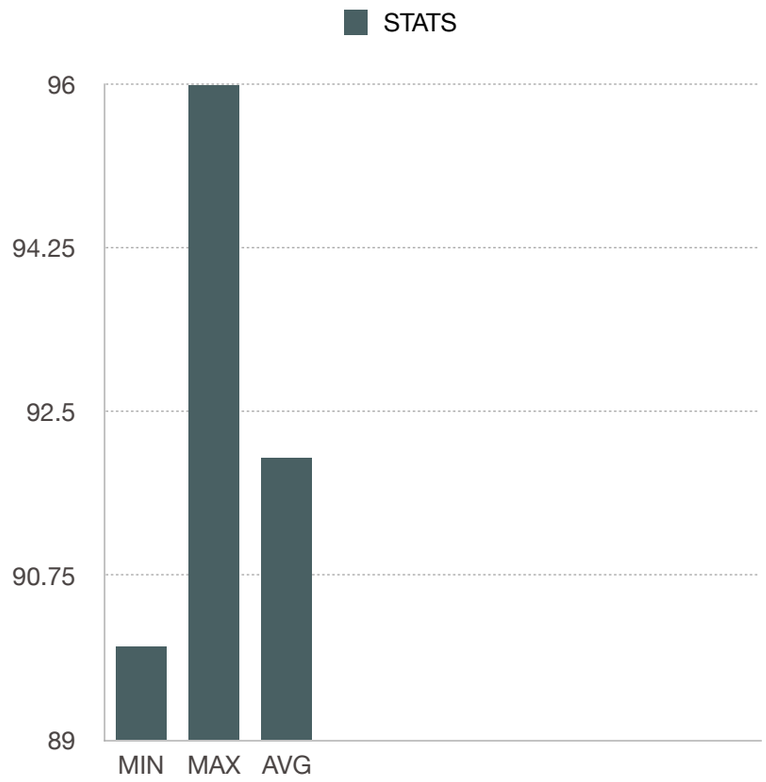


SUM:= 828

AVERAGE:=92

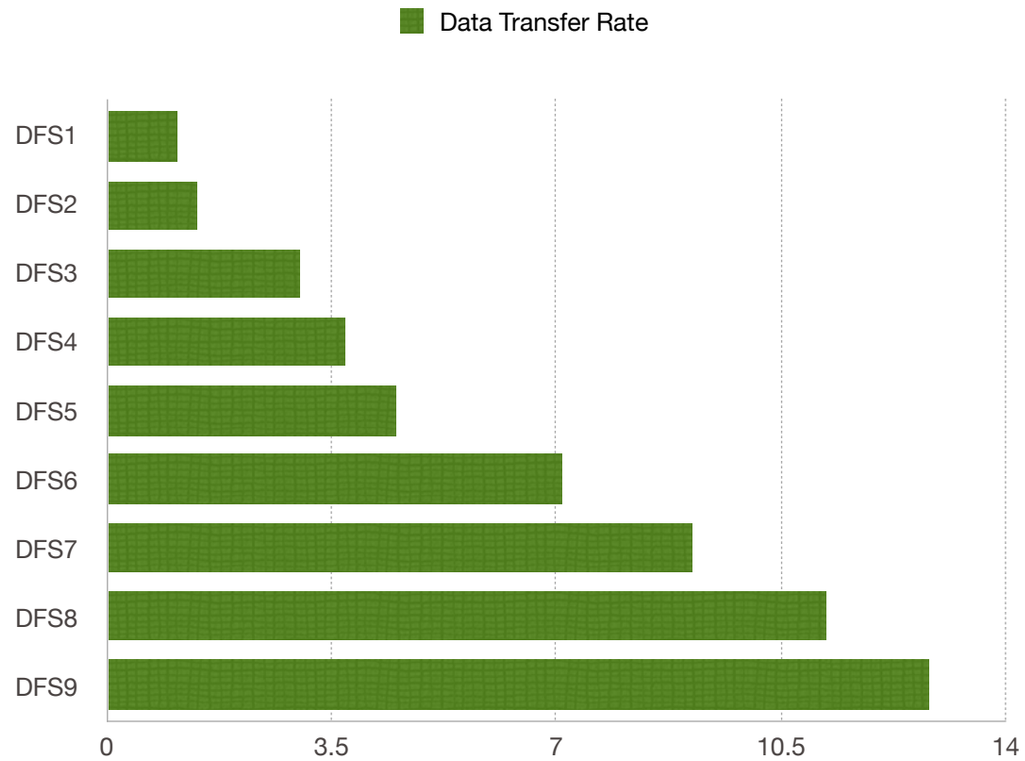
MIN:=90

MAX:=96



Statistics 6.1

Data transfer size(KB/s)
2.2
4.7
6.3
7.3
8.8
9.4
10.2
11
11.4

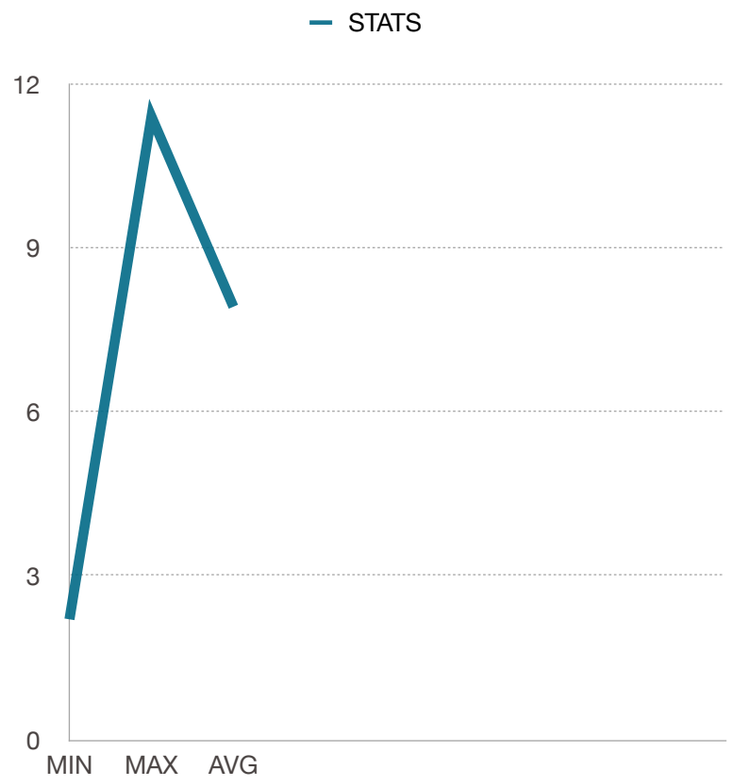


SUM:= 71.3

AVERAGE:=7.92

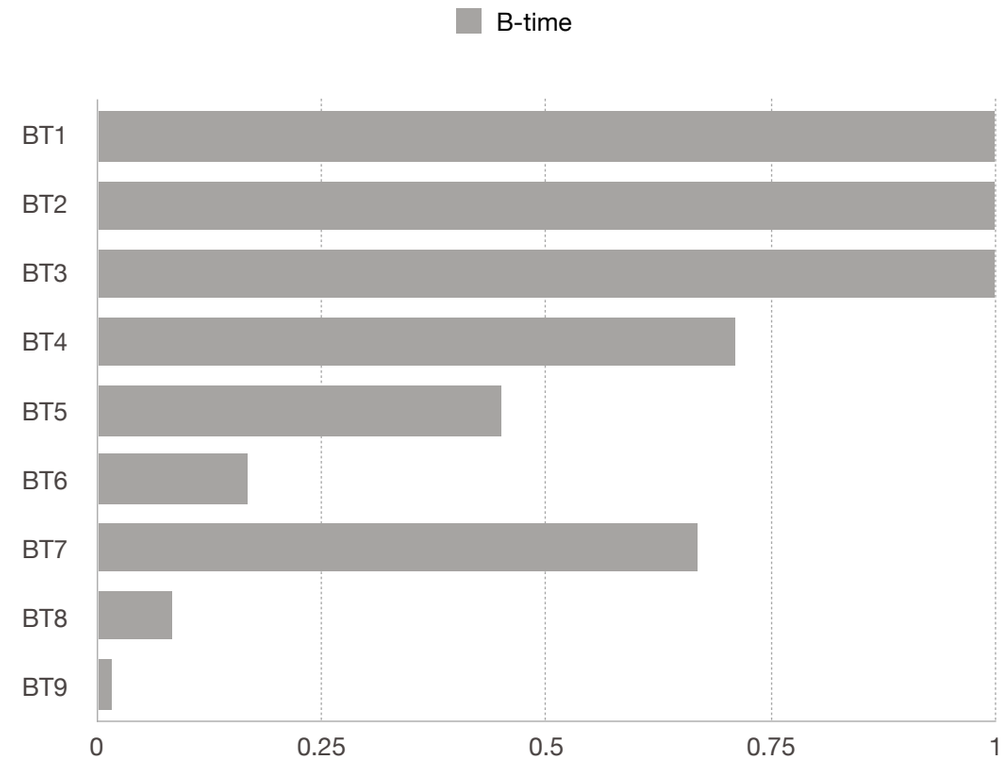
MIN:=2.2

MAX:=11.4



Statistics 6.2

B-time(m/s)
1m
1m
1m
43s
27s
10s
40s
5s
1s

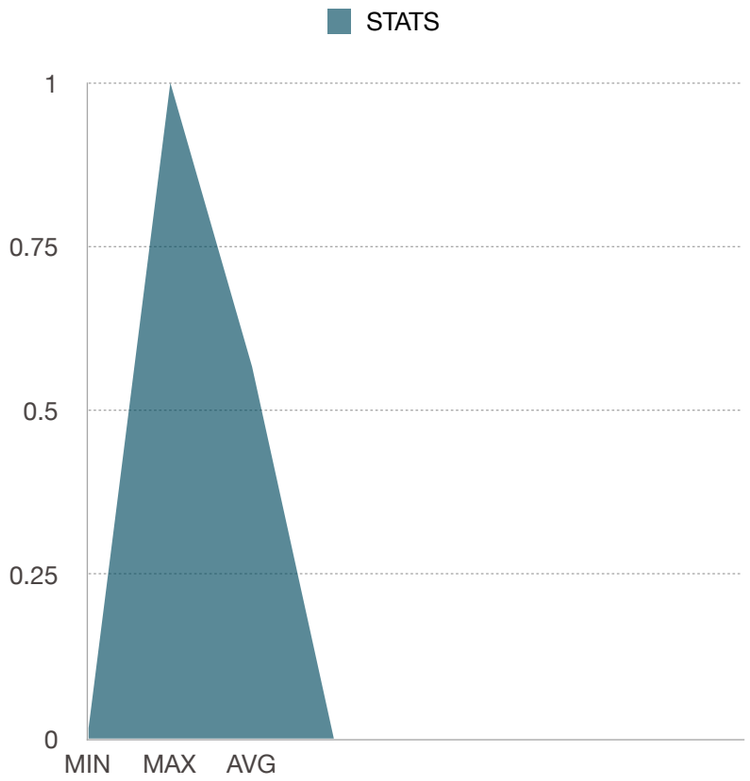


SUM:= 5.1

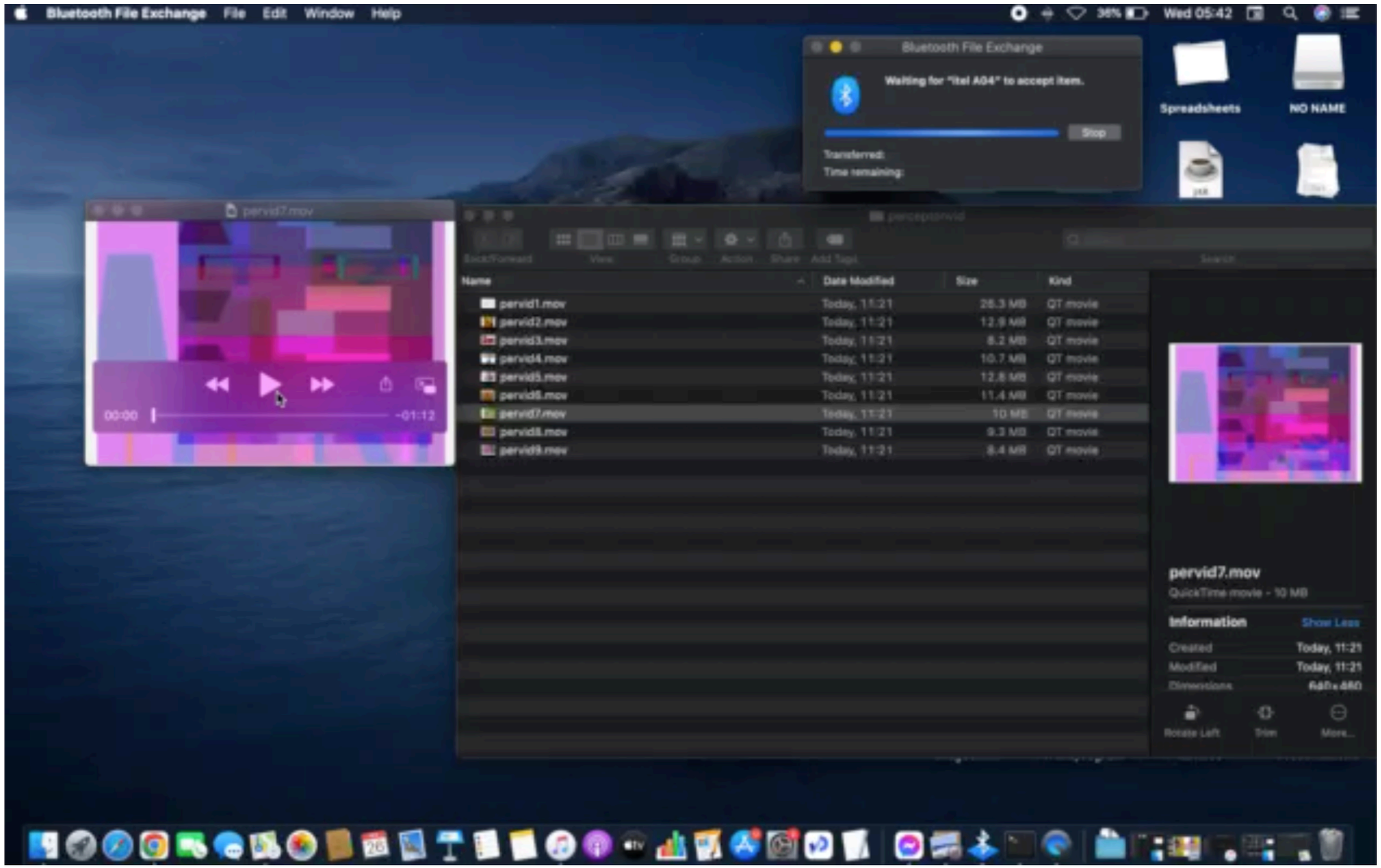
AVERAGE:=0.567

MIN:=0.016m

MAX:=1m



Media 7 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading s/m	M-time Lagging s/m	B-Time s/m	Data Transfer Size (MB)	Data rate KB/s
1:27m	29s	1m	2.0	94
1:12m	44s	1m	3.4	76
59s	57s	54s	4.7	94
1:41m	48s	54s	3.7	93
52s	1:04m	40s	4.5	95
43s	1:13m	37s	6.2	87
0:26s	1:30m	24s	7.8	91
8s	1:38m	10s	8.6	86
4s	**1:52m**	**1s**	**10**	**96**

(M)edia-Time

vs

(B)luetooth-Time

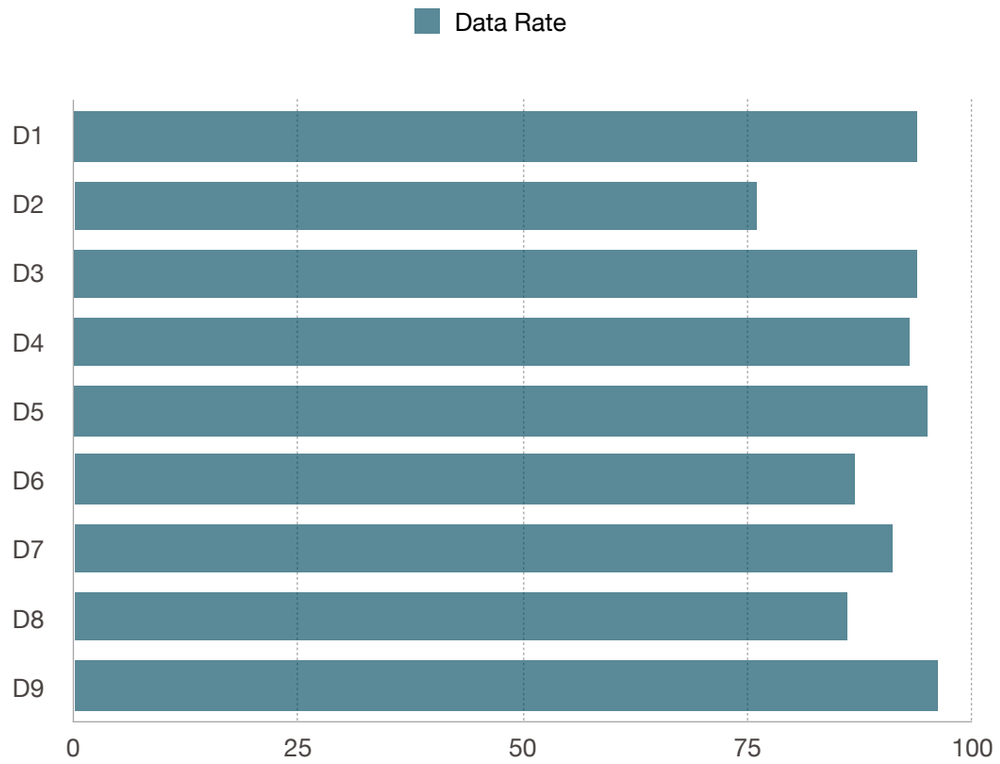
Vs

Data Size

The total file size is 10MB.

Statistics 7

Data rate(KB/s)
94
76
94
93
95
87
91
86
96

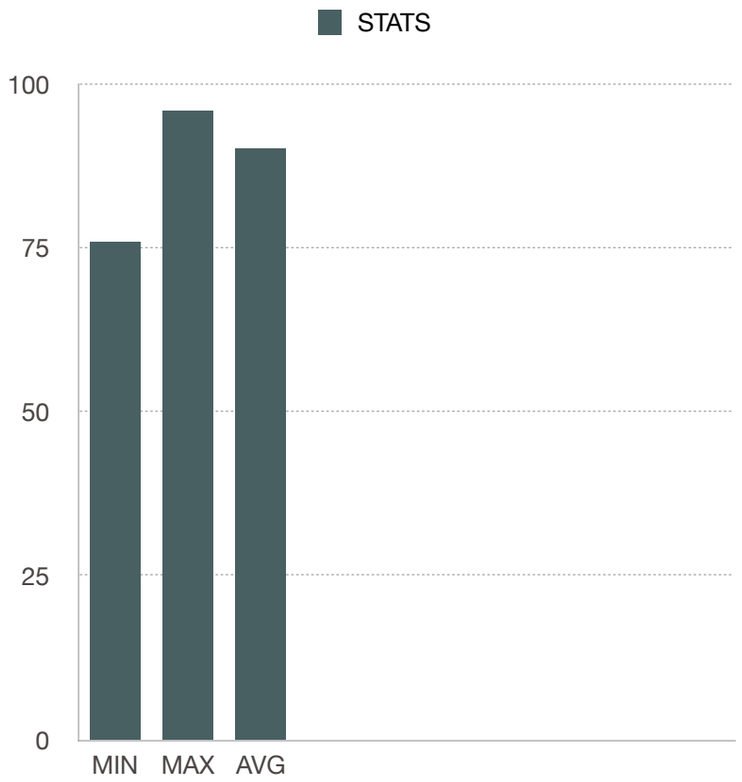


SUM:= 812

AVERAGE:=90.22

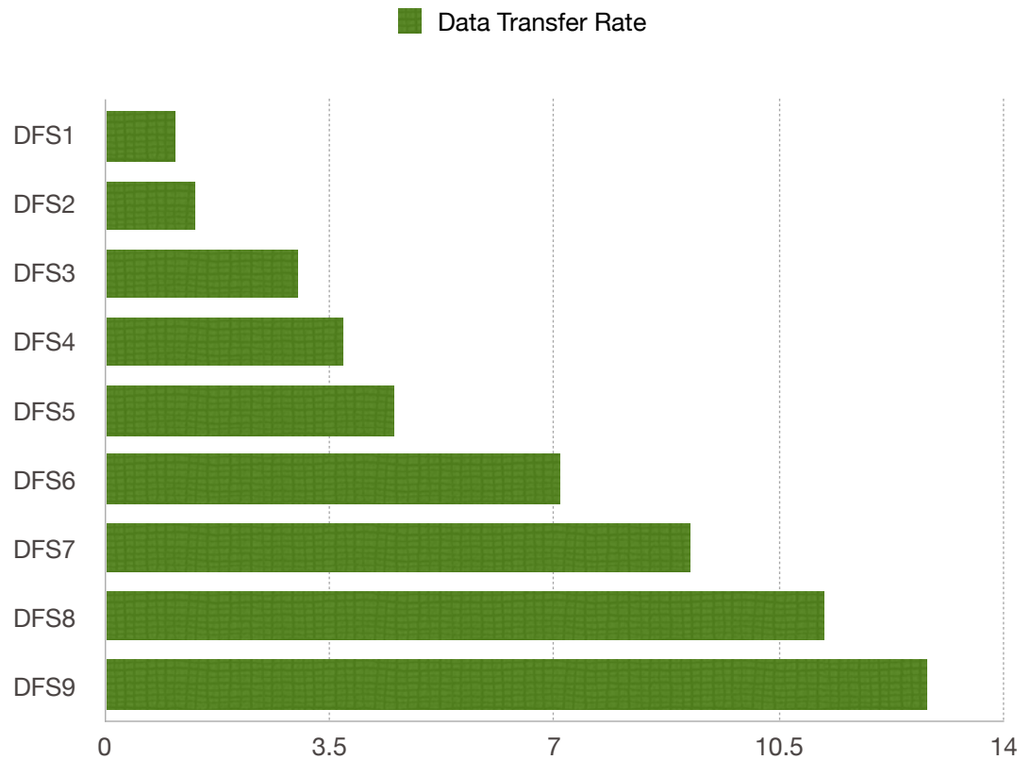
MIN:=76

MAX:=96



Statistics 7.1

Data transfer size(KB/s)
2.0
3.4
4.7
3.7
4.5
6.2
7.8
8.6
10

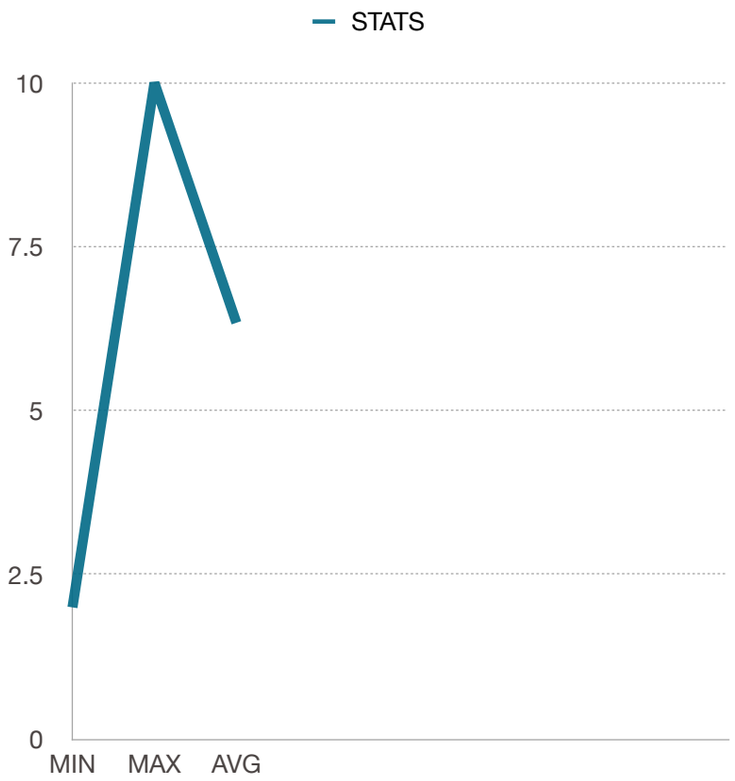


SUM:= 57.1

AVERAGE:=6.34

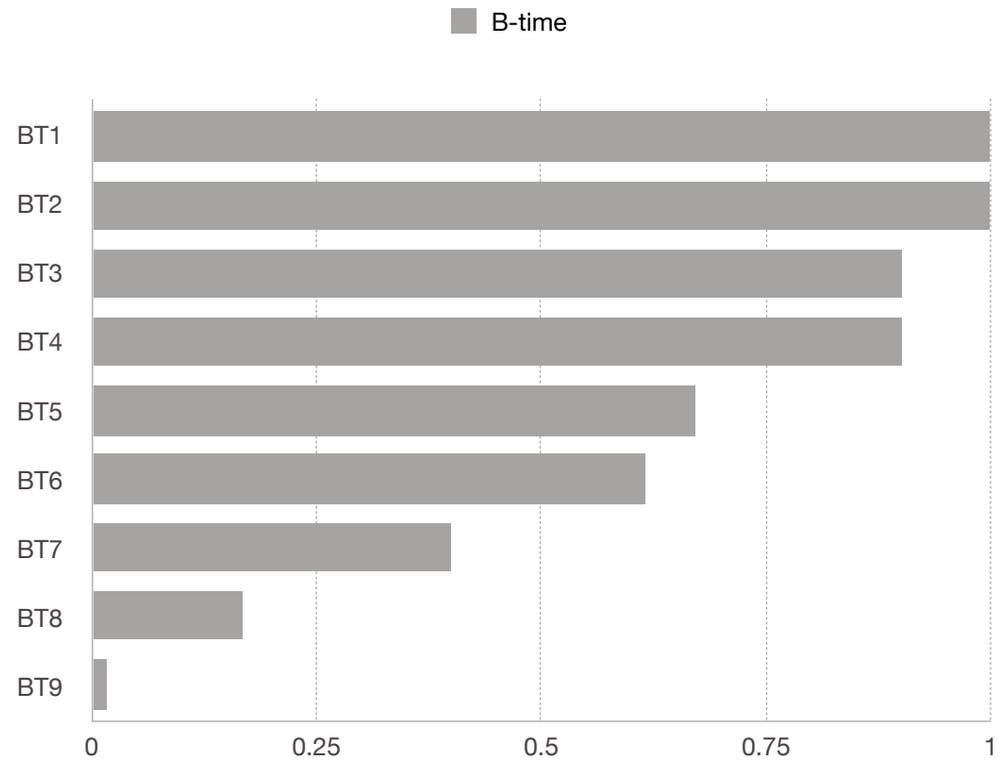
MIN:=2.0

MAX:=10



Statistics 7.2

B-time(m/s)
1m
1m
54s
54s
40s
37s
24s
10s
1s

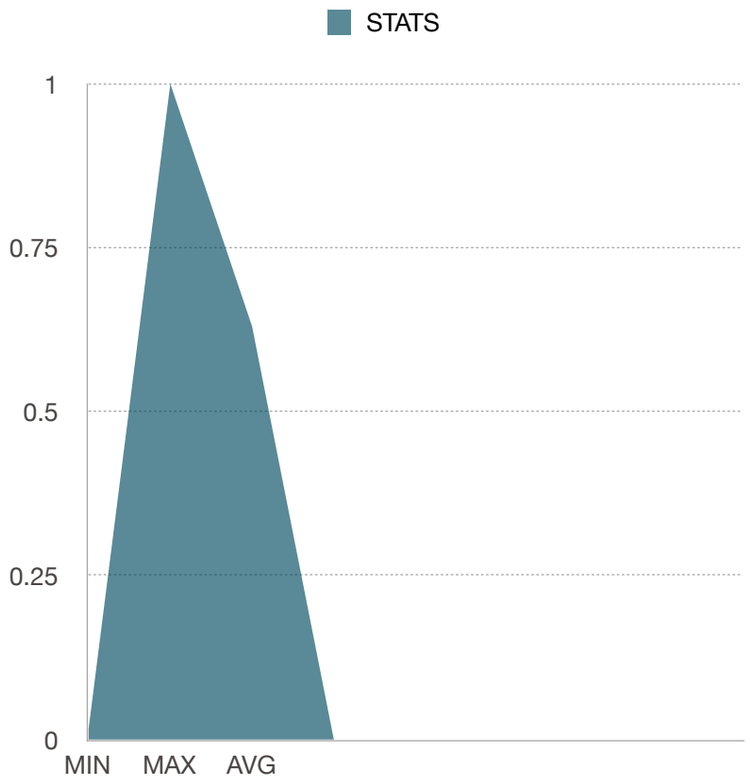


SUM:= 5.667

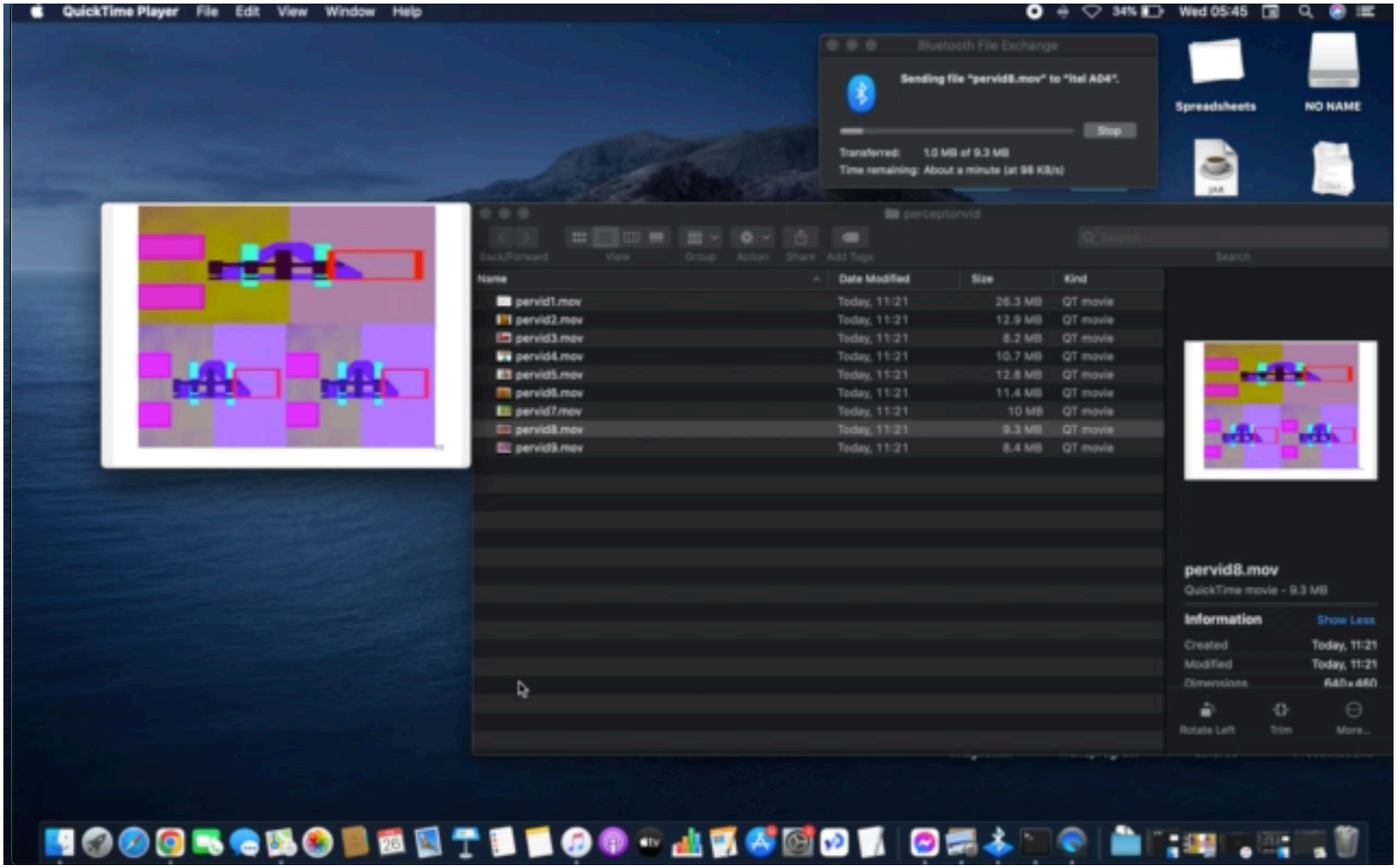
AVERAGE:=0.63

MIN:=0.016m

MAX:=1m



Media 8 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading s/m	M-time Lagging s/m	B-Time s/m	Data Transfer Size (MB)	Data rate KB/s
1:29m	15s	1m	1	94
1:09m	35s	1m	3.0	92
1:48m	41s	1m	3.0	94
54s	50s	52s	4.5	90
40s	1:04m	36s	5.9	90
31s	1:13m	27s	6.7	97
0:11m	1:33m	8s	8.6	93
5s	1:39m	1s	9.2	96
4s	**1:40m**	**1s**	**9.3**	**92**

(M)edia-Time

vs

(B)luetooth-Time

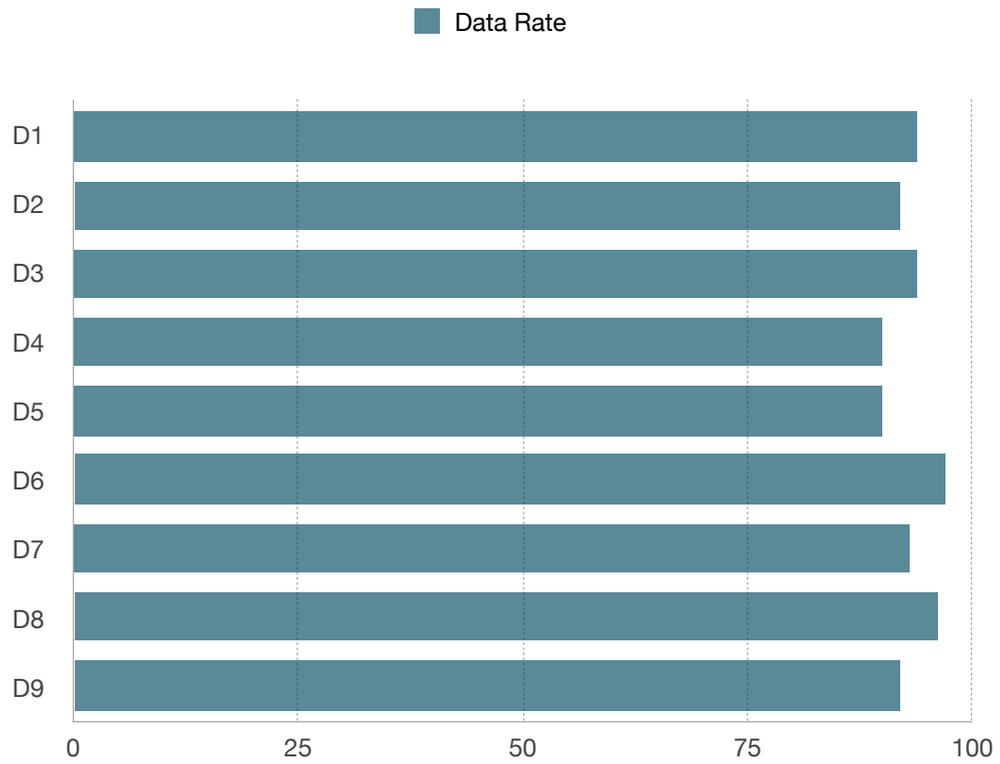
Vs

Data Size

The total file size is 9.3MB.

Statistics 8

Data rate(KB/s)
94
92
94
90
90
97
93
96
92

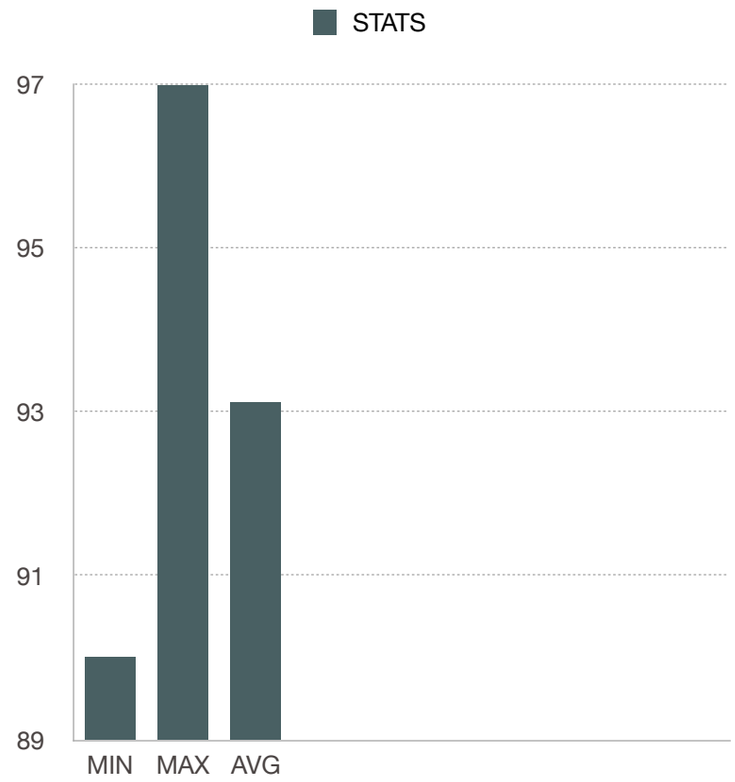


SUM:= 838

AVERAGE:=93.11

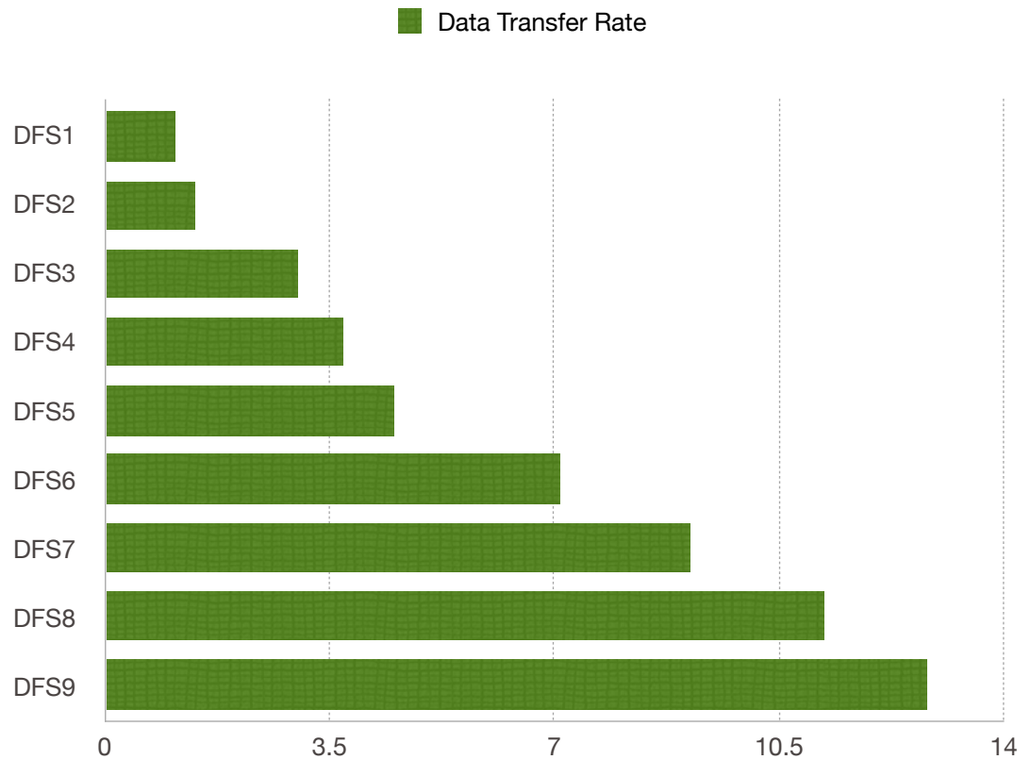
MIN:=90

MAX:=97



Statistics 8.1

Data transfer size(KB/s)
1
3.0
3.0
4.5
5.9
6.7
8.6
9.2
9.3

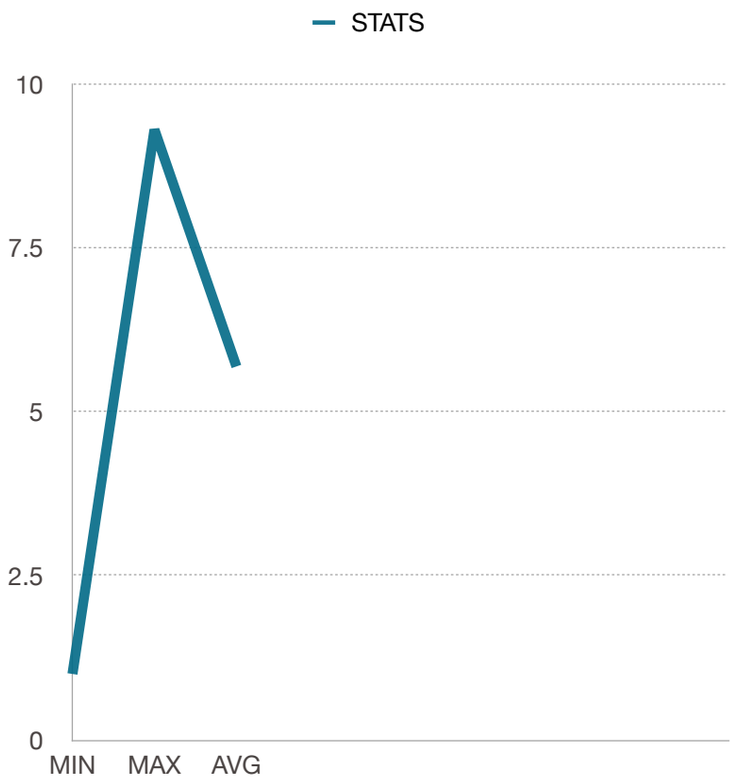


SUM:= 51.2

AVERAGE:=5.689

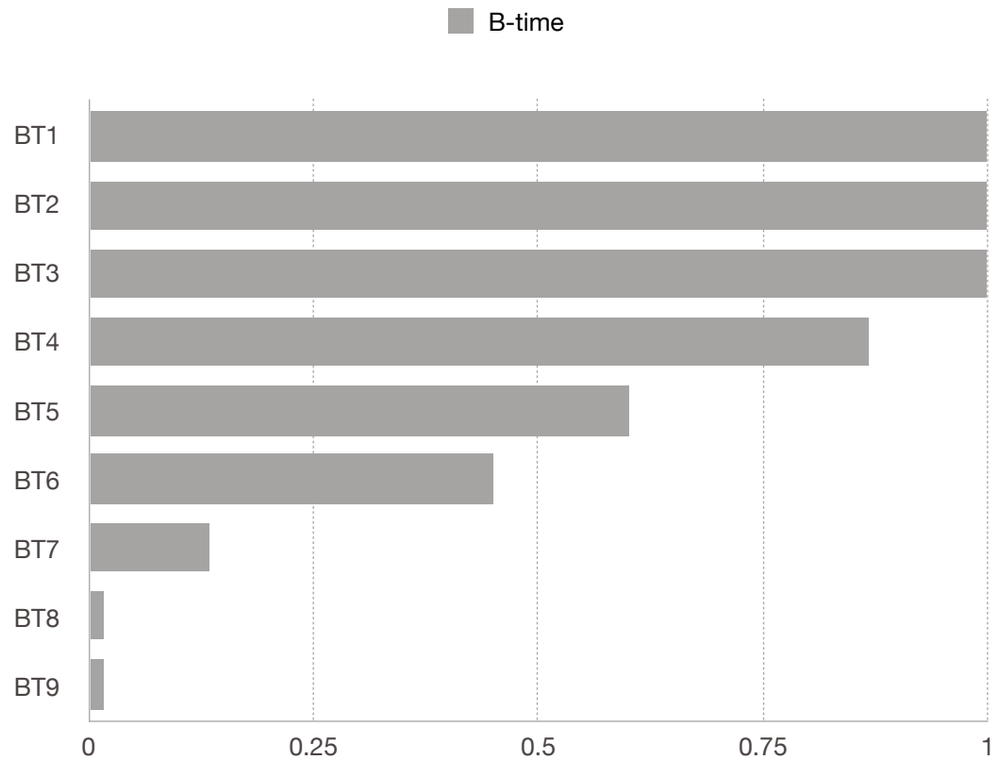
MIN:=1

MAX:=9.3



Statistics 8.2

B-time(m/s)
1m
1m
1m
52s
36s
27s
8s
1s
1s

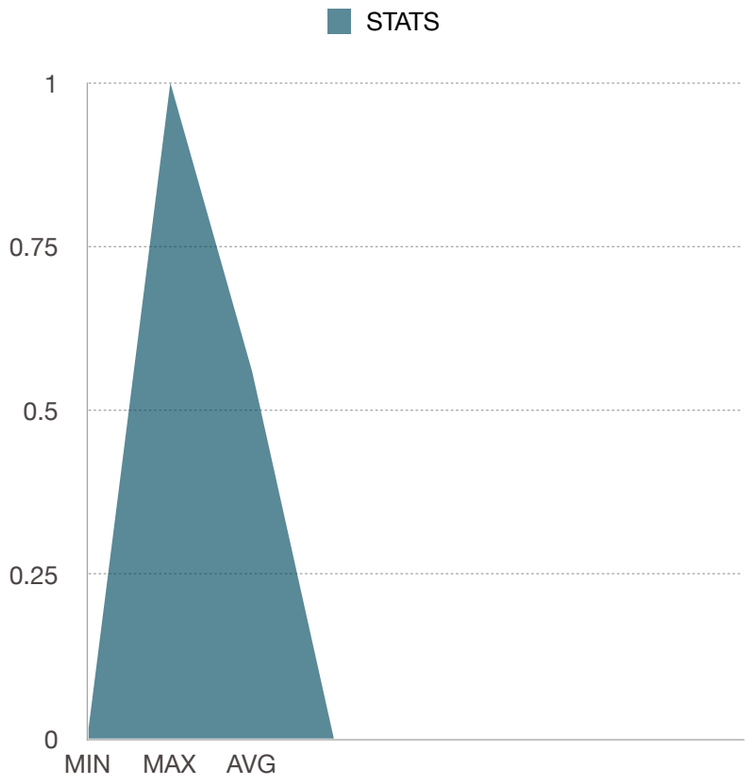


SUM:= 5.083

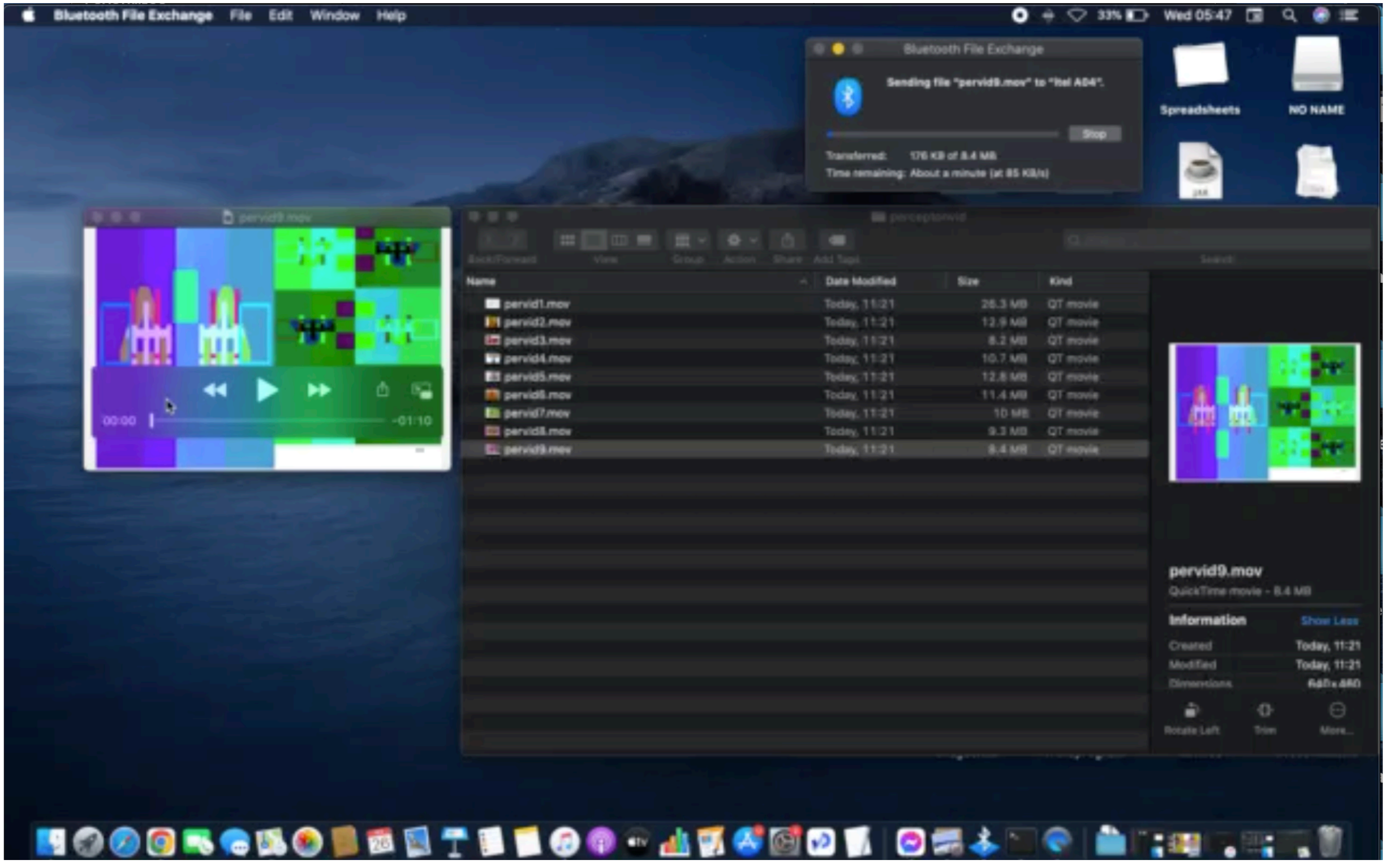
AVERAGE:=0.56

MIN:=0.016m

MAX:=1m



Media 9 Exchange View



S : Second(s)

M: Minute(s)

MB: Megabyte(s)

M-Time Leading s/m	M-time Lagging s/m	B-Time s/m	Data Transfer Size (MB)	Data rate KB/s
1:16m	17s	1m	1.7	85
1:01m	32s	1m	3.1	92
53s	40s	47s	3.8	94
43s	50s	52s	4.7	89
37s	56s	36s	5.3	90
30s	1:03m	27s	5.9	90
23s	1:10m	22s	6.5	83
15s	1:18m	14s	7.2	86
2s	**1:31m**	**1s**	**8.4**	**87**

(M)edia-Time

vs

(B)luetooth-Time

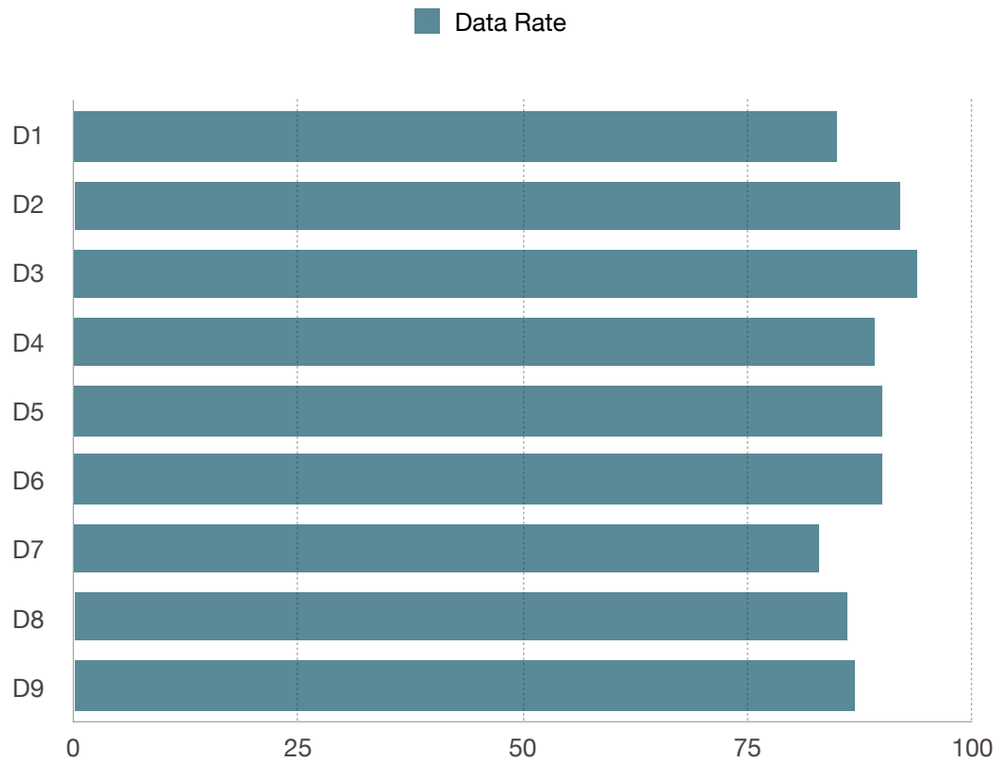
Vs

Data Size

The total file size is 8.4MB.

Statistics 9

Data rate(KB/s)
85
92
94
89
90
90
83
86
87

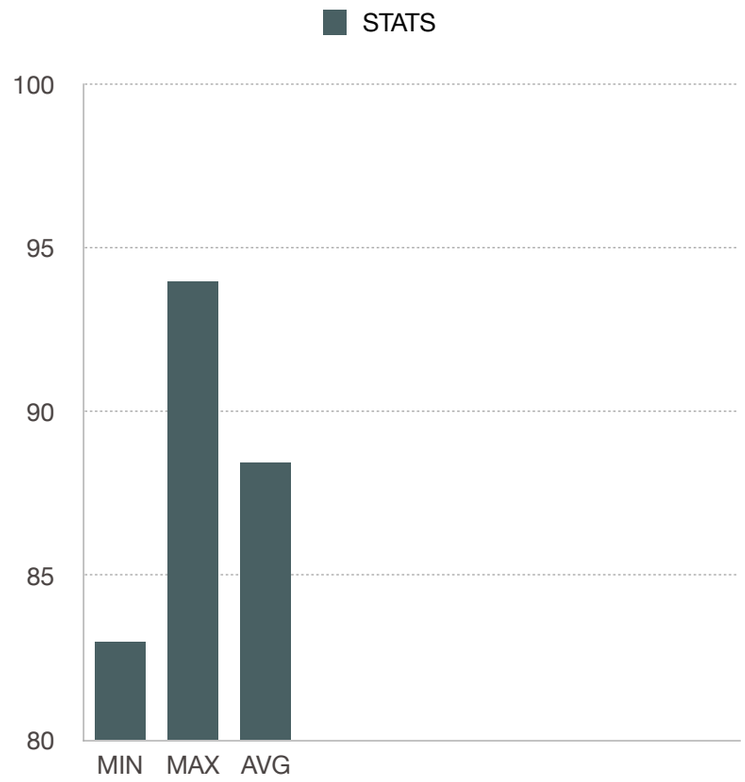


SUM:= 796

AVERAGE:=88.44

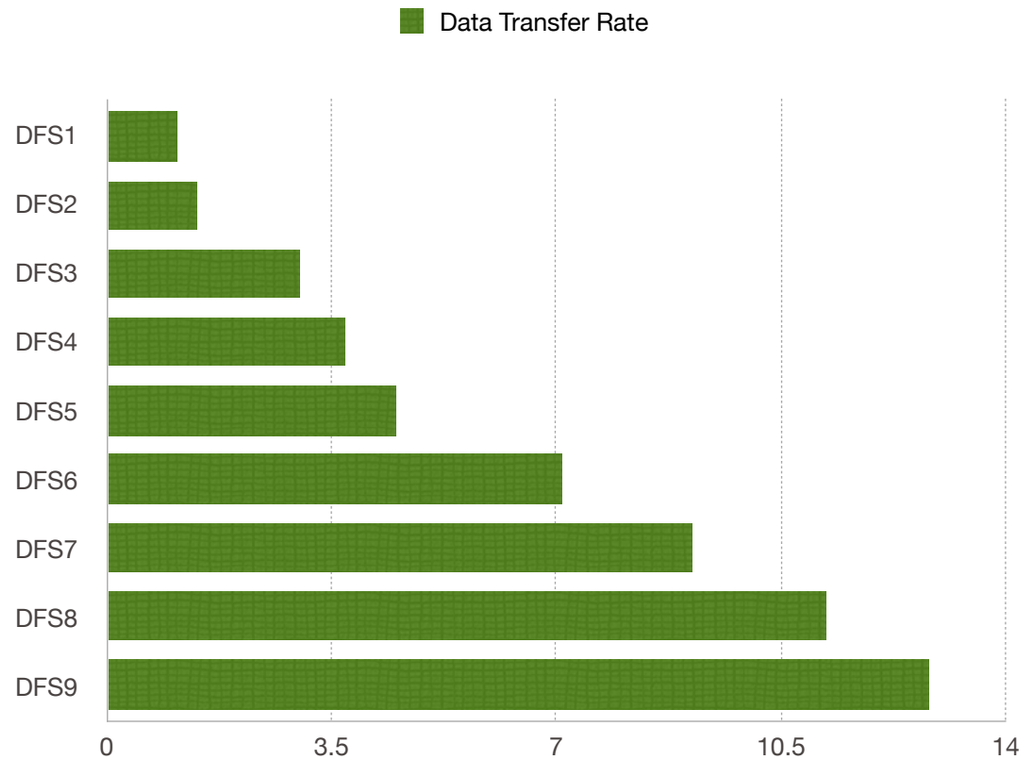
MIN:=83

MAX:=94



Statistics 9.1

Data transfer size(KB/s)
1.7
3.1
3.8
4.7
5.3
5.9
6.5
7.2
8.4

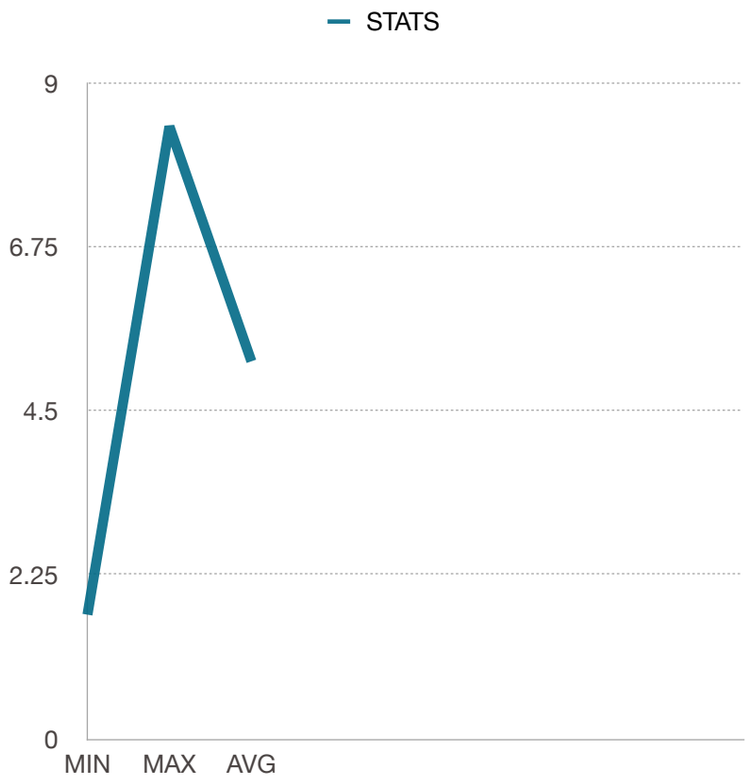


SUM:= 46.6

AVERAGE:=5.177

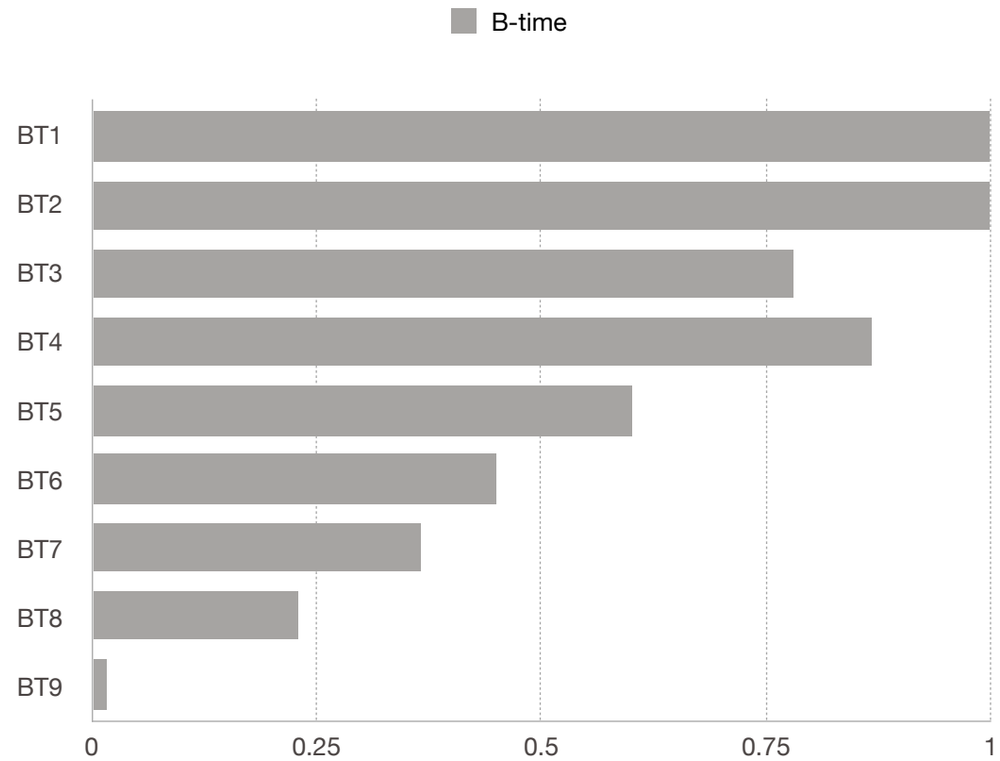
MIN:=1.7

MAX:=8.4



Statistics 9.2

B-time(m/s)
1m
1m
47s
52s
36s
27s
22s
14s
1s

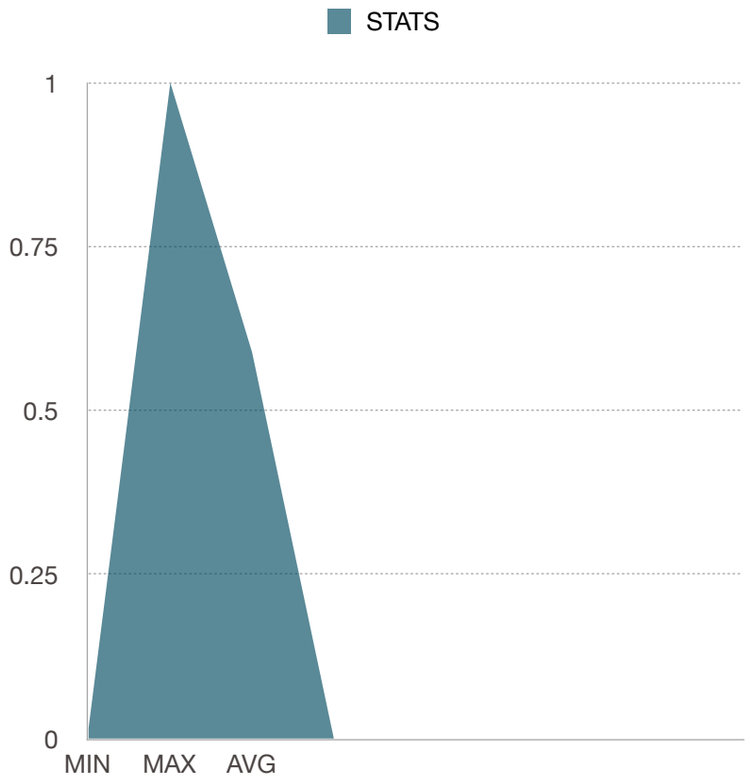


SUM:= 5.308

AVERAGE:=0.589

MIN:=0.016m

MAX:=1m



Conclusion

References:

1. *ITU, http://itu.int/net/ITU-R. (2025) Page on definitions of ISM bands.*
2. *Bluetooth, Bluetooth Special Interest Group. (2025) www.bluetooth.com*
3. *File Transfer Profile Specification Model (2025) www.bluetooth.com/specifications*
4. *Frank Appiah, Bluetooth Media Recording x9 (2025) www.archive.org/@frankappiah*
5. *David Spiegelhalter, The Art of Statistics: How to learn from data.*

This guide describes a file transfer protocol over personal area network build with a mobile and laptop each with enabled bluetooth devices. The connection network is initiated by the Laptop first by requesting a MOVE procedure then the mobile receives and bind to the L2CAP building the AMP procedure radio area network for personal communication. During the communication process, an onscreen video recording is made for each media file exchange. L2CAP is a logical link and control adaptation protocol and AMP means Alternate MAC/PHY. In sending a file to the mobile device, a file message is sent with Generic Object Exchange and Generic Access Profile. The mobile will either access or reject the file messaging. On accept, file exchange using OBEX over L2CAP begins on progressively propagating the file over the air interface. The laptop acts a Bluetooth server and the mobile acts as a client. In simple response mode(SRM), High speed capabilities of the devices are utilised. The guide makes a further media-time analysis with statistics from the data recorded times during the personal communication. A data visualisation is done with bar, line chart and area charts for the b-time, data transfer size and data rates of the laptop bluetooth profile.